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FORTY-SIXTH MEETING OF THE AMERICAN ASTRONOMCIAL SOCIETY, SEPT. 7-9, 1931

By CURVIN H. GINGRICH.

A large number of members and friends of the American Astronomical Society assembled in Delaware, Ohio, during the morning hours of September 7 for the purpose of holding the forty-sixth meeting of the society. It seemed that a more than ordinary amount of interest was felt in this session, induced, no doubt, by the prospect of seeing Perkins Observatory, one of the newest of the large observatories, and its unusual equipment. During the progress of the session this interest was further heightened by the activity and enthusiasm of the director, Dr. Harlan T. Stetson, and the members of his staff.

Upon arriving in Delaware the visitors found that every detail had been arranged for their comfortable entertainment at Austin Hall, a large dormitory for women on the campus of Ohio Wesleyan University. The dining room of this dormitory was opened and the luncheon hour there on the first day was used very effectively for the primary purpose of a luncheon hour and also for the exchanging of greetings on the part of the large number of guests who had congregated there by that time.

After the luncheon the group found its way, following explicit directions by Dr. Stetson, to the Perkins Observatory, also a part of Ohio Wesleyan, situated some four or five miles south of Delaware on a slight knoll in the open country. Here the first official session was called to order at two-thirty, by the secretary, Professor Raymond S. Dugan. Professor Dugan, as he himself said, was quite bowed down by the weight of the responsibility of filling the places of the president, two ex-presidents, two vice-presidents, the treasurer, and six councilors, all of whom found it impossible to be present at the meeting. He spoke fittingly of the large place which Perkins Observatory, still comparatively very young, was already occupying in the astronomical world, and of the pleasure which the American Astronomical Society felt in holding its sessions under such favorable and enjoyable surroundings. He also referred with regret, which was shared by all, to the inability of Professor E. W. Brown to be present, and mentioned that on his way to Delaware he had visited Professor Edward S. King, in Cambridge, who was then critically ill. By unanimous vote of the members present the secretary was instructed to convey by telegram the greetings of the society to these two well-known astronomers and valued members of the

society, the one, its president, the other, one of its councilors.

Dr. Stetson then responded to the introductory words of the secretary, most cordially welcoming the members of the society and their friends to the Perkins Observatory, and outlined briefly the program of events which had been planned for the period of their visit. Then followed the presentation of the first six papers which had been scheduled on the program.

The first four of the papers were concerned with the minor planets, the first two specifically with preliminary results arising from observations of Eros at its recent close approach to the earth, made at the Dearborn and at the Van Vleck Observatories. Another of the papers was by Dr. Stetson in which he brought those present up to date on the matter of the large mirror which is to be the principal instrument of the Perkins Observatory. This 69-inch, or to be very exact, as he said, the 68.95-inch mirror is now practically finished in the factory of Mr. J. W. Fecker in Pittsburgh. It was originally hoped to have the mirror in place by this time and to make the dedication of it a prominent feature of the meeting, but because of unforeseen delays this could not be accomplished. However, Mr. Fecker, in a conversation, stated that the work on the mirror had been carried to such a point of completion that the most rigorous tests fail to detect any error. It is therefore, doubtless, a safe assumption that before long the large mirror will be in place and the work of the Perkins Observatory be in full swing.

After the papers and before the session was adjourned, Dr. Edmund D. Soper, the president of Ohio Wesleyan University, was introduced. He extended the welcome, already given by Dr. Stetson, so as to include not only the Perkins Observatory, but also the entire University and even the city of Delaware. Everyone present felt entirely assured that the hospitality tendered so cordially was certainly genuine. President Soper also briefly related the circumstances leading up to the founding of the Perkins Observatory. It was surprising to many to hear that, solely from the resources of a very moderate salary, Professor and Mrs. Hiram Mills Perkins were able by careful saving and some successful investing to amass a sum of money large enough to provide, before their death, for so fine a structure and so large a telescope.

After the adjournment of the afternoon session the group soon found its way to the lawn just north of the observatory. Here, surrounded by a profusion of growing flowers and overlooking a bit of beautiful undulating Ohio landscape, an hour was spent in further exchanges of greetings and in partaking of the more material phases of a garden reception which were abundantly supplied by the University.

Except for a meeting of the council no other session was scheduled for this day. As a consequence the evening was spent in various ways, but for the most part in visiting and in playing games which did not make too great demands upon the somewhat depleted mental powers of all the participants. The parlors of Austin Hall were opened to the

guests for this evening and the surroundings were so collegiate, in the classical sense of that term, as to make one reminiscent and possibly to wish that time might turn back in its flight some five, ten, or twenty years as the case might be. The committee, consisting of the ladies connected with the staff of the observatory, saw to it that no detail was overlooked which might contribute to the pleasure of the visitors.

The forenoon of Tuesday was taken up with a meeting of the council and a general session for the reading of papers. The abstracts of all the papers which were presented at the meeting will be printd and distributed as before, hence no attempt will be made to deal with the technicalities of them here.

One paper, presented on Wednesday morning, that by Professor Slocum on the results of his extensive survey of conditions and available sites for observing the total eclipse of August 31, 1932, was listened to with great eagerness because most of the persons present, no doubt, were already making plans for that event. This paper will be published in its entirety in this magazine in the near future.

Tuesday afternoon and evening were used for an excursion and the Society dinner. Promptly at three o'clock some thirty-one automobiles, led by Dr. Storer, left Austin Hall for Granville, thirty-five miles east of Delaware. At this point the procession was met by two officers on motorcycles, especially commissioned by the city of Newark to conduct the party five miles farther to the environs of Newark, to view an elaborate system of mounds which are traceable to the work of the Indian tribes who inhabited this section before the coming of the white man. The enormous amount of labor involved in the construction of twelve miles or more of these mounds, which must have been done practically without any mechanical devices, and the symmetry of the arrangement of them are such as to inspire a feeling of great admiration for these early people because of their industry and their intelligence. The consensus of opinion seems to be that these mounds were constructed solely for religious ceremonies, the small isolated mounds which are found at various strategic points presumably being occupied by the Indian chiefs during the ceremonial rites. A representative of the Chamber of Commerce of Newark was at hand and very intelligently explained what has already been learned about the mounds and what lines of investigation are now being followed. It is believed that one section of the mounds is oriented so as to be directed toward the point at which the sun rises at the summer solstice. This aspect was of especial interest to the astronomers. A number of them, principally Professor H. T. Stetson who is near at hand, offered their assistance in making the necessary observations to ascertain whether this is a fact.

A part of the region covered by the mounds is now used as a golf course, the small mounds furnishing excellent places for teeing off. It is therefore a pertinent question as to whether the high purpose of worship for which they were built is being fulfilled!

After this delightful excursion and diversion the party was reconducted to the Granville Inn, all in a very suitable frame of mind and body to partake of the sumptuous dinner which was provided there. One hundred fourteen members and guests were seated in the ornate dining room of this beautifully appointed Inn and thoroughly enjoyed the viands so nicely prepared and so expeditiously served.

Following the dinner, Dr. Oliver J. Lee in a few well-chosen words introduced the versatile secretary, Dr. Dugan, who responded in his usual happy manner. He called in order upon Drs. Jordan, McLaughlin, Smiley, and Stetson, all of whom, each by a few remarks, added to the enjoyment of the occasion. Then Dr. Dugan called for volunteers, to which invitation three responded, namely Dr. Lee, Mr. Weld Arnold, and Mrs. Gingrich, the first two recalling personal experiences of interest to the fraternity of astronomers, and the third expressing, in behalf of the ladies who were present, a feeling of appreciation for the thought and care which had been expended for the pleasure and entertainment of those for whom the technical papers of the meeting might not form the principal attraction.

After this the group became informal again, some lingered for conversation in the parlors, some moved the tables aside in the dining room and practiced the terpsichorean art, and in due time all found their way back to Austin Hall,—the feeling that Dr. Storer and his helpers had arranged a perfect day being unanimous.

On Wednesday there were held the final meeting of the council, a business session, and one session for papers in the forenoon and one in the afternoon. A total of twenty-seven papers were read at the several sessions.

At the business session the secretary announced

1. that Professors Slocum and R. M. Stewart and Mr. Odin Roberts had been appointed a special committee on eclipse sites;
2. that Dr. Dean B. McLaughlin had again been appointed as assistant secretary for the coming year;
3. that Miss Caroline E. Furness and Professor A. S. King had been appointed as representatives of the Society to the American Association for the Advancement of Science;
4. that the meeting next December would be held at the U. S. Naval Observatory, Washington, D. C., and the summer meeting in 1933 in Chicago during the last full week of June. The summer meeting in 1932 will probably consist simply of a business session in connection with the meetings of the International Astronomical Union which are to be held in Cambridge during the first week of September.

A ballot for officers was taken and as a result elections were made as follows:

President	Dr. W. S. Adams	1931-1934
Vice-President	Dr. C. G. Abbot	1931-1933
Secretary	Dr. R. S. Dugan	1931-1932
Treasurer	Dr. Benjamin Boss	1931-1932
Councilors	Dr. J. C. Hammond	1931-1934
	Dr. P. W. Merrill	1931-1934
	Dr. H. H. Plaskett	1931-1934

Nominating Committee, Dr. Curtis, Dr. Schlesinger, Miss Anne S. Young.

The following were elected as new members of the society:

Ernest Cherrington, Jr., 235 W. William Street, Delaware, Ohio.
George C. Claridge, St. Norbert's College, West De Pere, Wisconsin.
Marvin O. Cobb, Perkins Observatory, Delaware, Ohio.
B. F. Dostal, University of Florida, Gainesville, Florida.
M. R. Ensign, University of Florida, Gainesville, Florida.
Ross Gunn, Naval Research Laboratory, Bellevue, Anacostia, D. C.
Hugh Grant Harp, 368 Stanton Avenue, Springfield, Ohio.
Junius J. Hayes, 1148 East First Street, Salt Lake City, Utah.
H. E. Hewitt, Linfield College, McMinnville, Oregon.
Morris K. Jessup, Detroit Observatory, Ann Arbor, Michigan.
Josef J. Johnson, Perkins Observatory, Delaware, Ohio.
Mrs. Maud W. Makemson, Rollins College, Winter Park, Florida.
Sidney McCuskey, Case School of Applied Science, Cleveland, Ohio.
Frances E. Naylor, Perkins Observatory, Delaware, Ohio.
Harold Schwede, Yerkes Observatory, Williams Bay, Wisconsin.
Carr V. Van Anda, 1170 Park Avenue, New York City.
Agnes Wells, Indiana University, Bloomington, Indiana.

Honorary Member:

Professor Willem de Sitter, Sterrewacht, Leiden, Holland.

At this session also Dr. Everett S. Yowell presented a resolution expressing the thanks of the society and its friends for the hospitality and entertainment so generously provided by the Perkins Observatory, the Ohio Wesleyan University, and others. The resolution was adopted unanimously.

After the afternoon session the more than one hundred persons, most of whom appear in the accompanying photographs, who had spent the three days together so happily and so profitably, started on their homeward journey, by automobile and by train, some north, some south, some east, some west, all, consciously or unconsciously, looking forward with pleasurable anticipation to the time when in the course of events the meeting should again be held at the Perkins Observatory and the same enjoyable experience be repeated.

THE ASTRONOMICAL FRATERNITY OF THE WORLD

By DAVID B. PICKERING.

PART IX

On January 31st of this year of our Lord, 1931, my wife and I sailed away from New York on our latest adventure. We wanted to see the glorious West, and to revive thus our patriotism and restore our waning self-respect. For several years we had been repeatedly running to Europe and had grown a bit conscious of the fact that we had neglected to investigate this land of our birth at an earlier opportunity.

It is well into April as I sit writing this within sight and sound of the blue Pacific, far down the coast of southern California. Below the balcony of our room, the warm sun spreads a golden cloth over the neighboring palm-encircled, rose-covered cottages. Honeysuckle crowds the boundary hedges and great blankets of bougainvilla and pink and mauve ice flower blossoms are spread in patches over the vista. Europe is far in the background of our memories.

We had moved leisurely through the Panama Canal and along the western coasts of Central America and Mexico on a slow steamer. We had had weeks of brilliant, unclouded weather. Within eight degrees of the equator, with Canopus high in the southern sky and Polaris just a hand's span above the northern horizon, we would wait nightly for the Southern Cross to emerge, jewel-dripping, from the sea. There it would hang upon its side, a glorious pendant at the base of the Milky Way. Hour after hour it would rise higher and more nearly erect until at culmination it stood more than twenty degrees above the water line, with those two brilliant gems, Alpha and Beta Centauri, aligned to the north of it. No more may anyone tell us that the Cross is relatively insignificant! Those who make this statement could never have seen this thing of glory as we saw it in those far southern waters.

A broken propeller delayed our arrival at the port of Los Angeles for a day, but within forty-eight hours thereafter, we were speeding across the Imperial Valley on our quest of astronomical adventure.

We had long planned that Arizona should be our first field of investigation, so this is to be, at least, part of the story of that wonder state and its wonder workers.

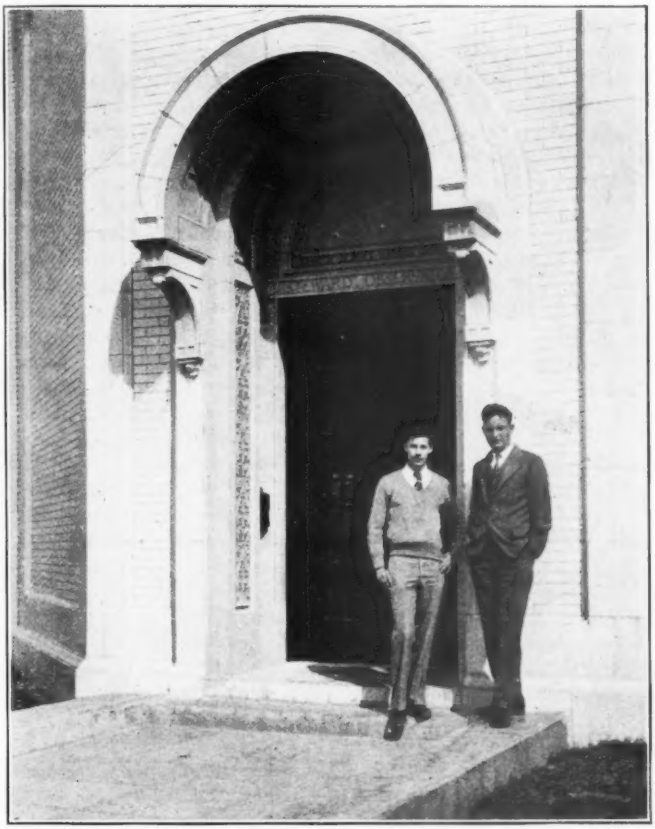
From near Yuma, where we crossed the Colorado River and the state line, our train kept climbing as it proceeded until we reached Tucson, 2500 feet above sea level.

There, in that new desert city, clean and colorful and enterprising, we found that sprinkling of Mexican and Indian population which, we were later to learn, forms a considerable part of the life of our great Southwest.

As we stepped from our train we figuratively fell into the arms of

Mr. and Mrs. Wm. Tyler Olcott, those dear friends who have been sojourning in this salubrious land for eighteen months or more. What a reunion it was, and how hearty they appeared, tanned by the desert sun!

We found quarters in town, and then drove with the Olcotts to their apartment, four miles out in the desert. Enroute, we saw the pictur-



DR. EDWARD CARPENTER (right) AND MR. JOSEPH MEEK AT ENTRANCE TO STEWARD OBSERVATORY.

esque mountain groups that rise from the plain and border the city at distances of from ten to twenty miles. Most beautiful of these, and nearest, is Santa Catalina, that frames the landscape to the north. Cactus forests stretch out to the base of the mountains, and high up their sides grow juniper and pine. Snow clings to the summit peaks, 4000 feet above the white sand of the desert.

We passed flower-decked villas, built in Spanish style, and glimpsed the dome of the Steward Observatory adjacent to the red brick buildings on the campus of the University of Arizona. On the green lawn at the side of their cool, concrete bungalow, the Olcotts told us of their life on the desert; of their friends from the observatory and of the writing which Mr. Olcott had done during their stay, writing which included a thrilling novel of war times.

As the lowering sun cast deeper shadows on the rugged face of Santa Catalina and the feathery pampas grasses nearby caught the pink tinge from the approaching sunset, a little car drove up and out jumped two young men and a young woman. It was thus, for the first time, that we met Dr. and Mrs. Edward Carpenter, of the staff of Steward Observatory, and Mr. Joseph Meek, an ardent amateur astronomer, all members of the A.A.V.S.O.

The romances which have led to the unions of many star-loving couples would make an interesting side-light to the history of astronomy, and would surely include that of Dr. Carpenter and his charming wife. This tall, quiet, smiling chap, now in his early thirties, worked under Dr. Stetson during his years at Harvard University, and after graduation, received an appointment to Lick Observatory. There too, came a young lady, fresh from her studies at Mt. Holyoke and full of ambition to make her mark in the astronomical world. They met, but she returned later and taught for two years at Mt. Holyoke. But the die was cast (or however one expresses that sort of thing) and in 1927 they were married and came to Tucson and, it seems a reasonable prophecy, lived happily ever after.

Ed Carpenter (we can't keep calling these young fellows "Doctor" and "Professor" at our advanced age) is immensely interested in his work and indulges in those periods of happy abstraction which characterize those who concentrate deeply on their problems. Mrs. Carpenter, whose vivacity and alertness form not a little of her charm, keeps careful watch over her talented husband. She offers him much technical assistance when that is called for, but at other times, brings him back to earth with a delicious, chuckling reprimand.

On a subsequent morning, I met Dr. Carpenter at the Steward Observatory and learned the history of that institution—a history that is closely associated with the record of scientific progress in Arizona and centers largely about the career of one man—Dr. Andrew Ellicott Douglass.

To start at the beginning, one must go back to the time when the Harvard College Observatory was seeking a station in the southern hemisphere. Dr. Douglass, as a member of that institution, accompanied Professor Wm. H. Pickering to Arequipa, Peru, in 1891, and for two years labored with him in establishing the branch observatory at that place. It was Professor Pickering's great interest in the study of Mars which formed at least a contributing urge to induce Professor Lowell to go into the Far West for the purpose of investigating that

planet. Dr. Douglass was the man selected to determine upon a site in Arizona for the prospective Lowell Observatory. In February, 1894, he went west. Armed with a portable telescope, he visited city after city, studying the observing conditions in the vicinity of each—Tombstone, Tucson, Phoenix, Prescott, and Flagstaff—and it was on a site above the last named place, at an elevation of 7200 feet, that the Lowell Observatory was established.

Here Dr. Douglass remained, associated with Professor Lowell, until 1901, when the sense of his isolation on Mars Hill began to oppress him. He severed his connection with the observatory, accepting a call to teach in the Flagstaff Normal School. His new position gave him the chance to enter local politics, mingle with men and affairs, and to free himself from the solitude of his former vocation. In 1906, he was called to the chair of physics and astronomy at the University of Arizona in Tucson. When the University acquired an observatory, Dr. Douglass became its director, and still holds that position.

Just how Tucson became possessed of a University, and later of an observatory, is a very interesting story as they tell it down there. Back somewhere about 1885, Tucson, very proud of itself and hungering for fame, sent a man by the name of Selim M. Franklin to represent it in the legislature of the state. His party charged him to procure for Tucson a prison or an asylum—something, at any rate, that would put Tucson "on the map."

Mr. Franklin, however, had ideas of his own—ideas far beyond the vision of his townspeople. He dreamed of a great institution of learning—a state-wide university, placed there on the desert. And through his efforts, the university became a reality. His home folks were bitterly disappointed with the result of his work. They could see fame for their city as the site of a well-filled State's Prison or a good, lively lunatic asylum, but they felt that an educational institution would be a "flop."

Some of these civic idealists were so disgusted that they hung Mr. Franklin in effigy. Yuma got the prison—but since Yuma was considered to have fame enough already, because of her proximity to the Colorado River, the prison was later moved to Florence. Needless to say, time has vindicated Mr. Franklin. Yuma still slumbers by the Colorado. Florence, in spite of her prison, remains unsung and unvisited. Tucson, however, with the splendid campus of her university, whose beautiful buildings house 1700 undergraduates, has drawn thousands to her doors and is famous as a city of culture and progress.

There was no astronomical instrument at the University of Arizona when Dr. Douglass joined the faculty, but in 1909 he procured from Harvard an 8-inch telescope, and this was made to suffice for a dozen years—years in which Dr. Douglass left no stone unturned in his efforts to acquire major astronomical equipment. In 1916, a lady of Tucson, Mrs. Lavinia Steward, being interested in astronomy and having a small glass of her own, was prevailed upon to make a gift to the University

for the establishment of an observatory.

The contract for the great 36-inch reflector was given to Brashear & Company in 1917, but the war came on and in 1918 Mrs. Steward died. The instrument, finished by McDowell, was not installed until 1921.

The conditions of the gift stipulated that the site of the observatory should be upon the campus of the University—a regrettable clause, for, though placed as far from the other buildings and activities as possible at the time, it is now rapidly being encroached upon. It is, however, becomingly situated at the end of a long road lined with trees, and, as we approached it that March morning, it seemed hardly large enough to house its massive instrument.

Passing through the portal, one enters a sizable lecture room. About forty of the students are participating in the first year course. Leaving the lecture room at the right, one ascends a few steps to an observing platform where is located the ocular for using the 36-inch mirror with the light that is reflected through the polar axis of its mounting. It is, I was told, the third instrument in this country so equipped, the two others being the 100-inch and the 60-inch reflectors at Mt. Wilson.

From the end of the lecture room opposite the entrance, stairs wind upward to the second floor where, on the right side of the short hallway, are located dressing-room and shower bath, adjuncts that must afford great relief to the astronomers during the torrid desert summer. Next to these, is the well-equipped dark-room, and opposite are the offices of Dr. Carpenter and the stairs leading to the dome. At the end of the hall, toward the front of the building, is the office of the Director. Dr. Carpenter led the way up the characteristic winding stairs and into the dome, where we found ourselves before the great telescope. The massive mounting is of the forked type, and the mirror end of the skeleton tube is shrouded in a hood of wool and canvas to mitigate sudden changes of temperature. In this connection I was shown an ingenious device, intended further to protect the mirror from thermal changes as well as from dust and moisture. This consisted of several sections of flat, woolen material, stiffened on the outside, that came in contact with and covered the entire surface of the silvered mirror. These sections were hinged at the rim of the circle and all could be raised by wires from the observing platform, exposing the mirror. Attached to the tube, near the observing end, was a splendid 5-inch photographic lens by Fecker, while refractors of 2¼ inches and 2 inches formed a battery of telescopes all carried on the same mounting. The work of the observatory at present, consists largely in the photometry of nebulae—determining the surface brightness and integrated magnitudes. Plates 3x3 inches are exposed to the light from the 36-inch mirror at a focal length of 180 inches at the same time that plates 6½x6½ inches are being made with the 5-inch at 30 inches focal length.

Through the open dome, we looked across the desert to the city beyond. Then down upon the broad campus directly below us. A great hall stands near the observatory where the cavalry troop of the college

holds its drills. Boys and girls were playing tennis on the clay courts next to this edifice; a football field spread out beyond it, while a flourishing cactus garden still farther on separated these open areas from the clustered, red brick buildings of the University.

Before closing the dome, we descended to the office of the Director, who graciously interrupted his work to greet us. Here was the man who has so largely been responsible for the activities of science in Arizona. Dr. Douglass welcomed us with that sincere, cordial smile which I know to be as much a part of him as his twinkling eyes, his thick, gray hair, or his clear, decisive voice. Well set-up, of medium height, sturdy and strong for his years, he impresses one with the fact that he has a man sized job to do and is keeping himself in training to take care of it. Indeed, as we learned more about that job and saw some of the results of his efforts, we wondered how one man could have accomplished so much and understood better that appearance of restrained energy which his manner suggests.

We had been invited to dinner by Dr. and Mrs. Douglass that same evening, and in the glory of an Arizona sunset, drove there with Dr. and Mrs. Carpenter. The Douglass home is of the bungalow type, and is situated on one of the broad, beautiful streets of the flowerful city.

Mrs. Douglass, who greeted us on our arrival, is both cultured and vivacious—a most entertaining hostess—such a one as anticipates every need and comfort of her guests. She is a graduate of Radcliffe College and later taught English in the college at Flagstaff. Here we found our friends the Olcotts and had the pleasure of meeting Mr. and Mrs. Arthur Cowperthwaite, a delightful couple who came to Tucson years ago and have established a splendid home on the edge of the desert.

Naturally a man of great versatility, Mr. Cowperthwaite became interested in astronomy through Dr. Douglass, studied the subject at the local University, and, on one occasion, substituted as lecturer for Dr. Douglass during a short absence of the latter from his post.

What a delightful dinner party that was! And after dinner, Dr. Douglass regaled and enlightened us with reels of moving pictures which he himself had taken—one showing desert flora, a splendid example of color photography, was startling in the brilliance and profusion of its blossoms. A copy of this film should be in the state archives of Arizona to show the world how the desert has been made "to blossom like the rose." Other reels, made abroad, showed us Dr. Douglass investigating the tree rings of Scandinavia, and also his visits to some of the observatories of Europe. Most interesting of all, however, was a series showing the technique of tree-ring work in Arizona. Extracting the bores from trees and ancient beams by means of cylindrical drills; shaving the surfaces of the bores thus obtained with safety razor blades; reading the story told by the rings thus exposed—but more of this anon.

Later, there were two tables of contract—a game our astronomical friends played with all the ardor and concentration with which they would undertake the computation of an orbit. It was very late when

Dr. Douglass motored us back to our hotel, inviting us to visit the campus at another time to see his tree-ring laboratory and to learn of the progress he was making in that unique research to which he is now devoting his life.

The following days were full of activity. On one of them, the Carpenters took us by motor to visit the famous mission of San Xavier del Bac—called by the Indians "The White Dove of the Desert,"—built by the Franciscan monks in 1797. Enroute, we passed through the Indian villages of the Papago tribes, lying on flat country near the "washes" of now dry streams and separated from the city by several miles of cactus covered hills. Women and children worked and played about the neat, mud-covered log cabins that formed their dwellings. On our return, we stopped to see the famous Desert Sanatarium—that station of the Carnegie Institute of Washington, established for the purpose of conducting research in solar radiation. Here are installed instruments similar to those devised and operated by Dr. Pettit of Mt. Wilson.

The buildings of the Sanatarium rise from a great desert plain to the northeast of Tucson and close to the feet of the Santa Catalina mountains. Farther to the eastward are the ruins of old Fort Lowell. The sun had reached the western horizon while we were still some miles from town, homeward bound. The west swam in gold and rose. Rose shadows settled in all the valleys of the Catalina Mountains to the north, and the eastern sky, catching the glow, tossed it back across the zenith until earth and sky together seemed to lie in the very heart of a giant rainbow. It was the view supreme. Never again may we hope to see its like!

On a subsequent afternoon, we participated in a delightful luncheon at the Arizona Inn—one of those new hostelries which, like the Conquistador Hotel, is drawing famous people to the health-giving climate and native beauty of the desert. After luncheon, there was coffee in the patio, with much gaiety and merry chatter. How charming the ladies appeared, in their nebulous summer frocks, under the sifted sunshine of the vine-covered pergola!

Then there was a day when Dr. Edward and Mrs. Hazel Carpenter took us for a picnic party into the desert, thirty miles to the east. Mrs. Carpenter, from the rear seat of their machine, "helped" her patient husband to negotiate the route to the Giant Cactus Forest. (I can imagine her staccato exclamations of resentful indignation when she sees this.) However, we did get lost—which she, with true wifely spirit, said *always* happened when Ed drove. But there we were at last among plenty of the great Sahuarro, some of which rise to heights of 30 or 40 feet, and between them were all the small revarieties of cacti, with always the distant background of snow-covered mountains. On the white, dry sand of the desert, we sat and ate our lunch, entertained by the sight of occasional lizards and frequent but swift jack-rabbits. Fortunately, the rattle snakes, which are known to inhabit the plain, were not in evidence, though we kept a wary eye out for them. We rambled

among the wild plants, learning to avoid too great a familiarity with their branches. I had previously had one painful encounter with a cholla, sometimes called the "Jumping Cactus," after which I had spent a good part of the next 24 hours extracting barded darts from the palm of my hand. I now feel the appropriateness of its common name, for I shall always believe that I never quite touched it, but that it sensed the approach of my fingers and, with devilish but protective instinct, severed and catapulted a well-armed part of itself into my hand. We heard stories, which can well be believed, of the agony of starving cattle seeking food from such sources.

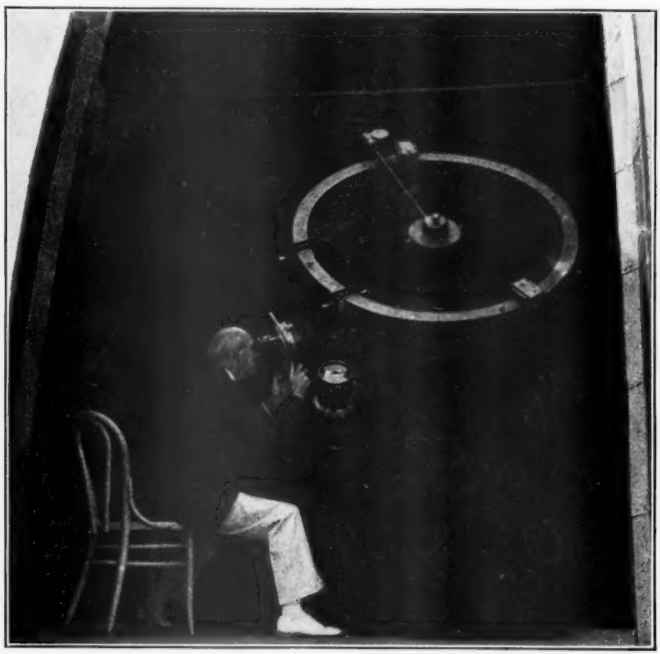
One should always approach a cholla plant with the same eagerness with which a dog runs to meet a porcupine.

Before our return to the city, we called at the Cowperthwaite home. There, on the spacious grounds about their beautiful residence, covered with innumerable varieties of cultivated tropical plants, are tennis courts, a swimming pool, and a neat observatory with a sliding roof, wherein Mr. Cowperthwaite has installed a fine 4-inch Clark refractor. This he employs with the care and precision which characterize all of his many activities. Upon entering the house, we were led, with closed eyes, into a large living room, and when we were bade to look, we found ourselves gazing through a huge plate-glass window filling an entire section of the walls of the apartment and framed like a massive picture. And what a picture it was! Not a human habitation met the eye. In the foreground spread a cactus garden containing all varieties of desert flora, while beyond stretched the desert, dotted with sage and palo verde. In the background, 15 miles away, stood the dark and rugged crags of Santa Catalina, bathed in the rose spray of the sunset. What a picture the God of Nature had painted to decorate the wall of their room!

One day we learned that Dr. Harlow Shapley was expected to pass through town on his way from Palo Alto to Houston. It was like Dr. Douglass to plan immediately for us to dine with him and Dr. Shapley at a local club. There we met, with Dr. Carpenter and Mr. Olcott, and as may be imagined "when good fellows get together," we had one of those rare hours among friends that mean so much to those who are far from home. From the club, we repaired to the observatory, where the 36-inch telescope was found ready for our use. The night seemed to have been made for us, so still, so clear and moonless it was. We mounted the platform in turn, and were not surprised to find that Dr. Douglass had selected Mars, though rapidly receding, as the first object to show us. And what more natural, for he, of all men, has probably made the longest continuous series of observations of that planet, having begun in 1892 and never having missed an opposition.

Then came in turn, Jupiter, the Orion Nebula and the great spiral in Canes Venatici. Many of us had never before had the privilege of observing these objects through a glass of that size, and certainly not through such an atmosphere. Jupiter gave us a special exhibition, for

not only were the details of structure in the southern cloud belt well diversified and extended more than half-way to the pole, but the shadow of one satellite threw a perfectly black disc midway upon the equator, while another was about to be occulted. We watched the latter creep behind the limb of the planet, and were startled to note how long it took to disappear after first contact.



D. B. Pickering at the Newtonian Eye-piece of the 36-inch Reflector.

Most remarkable of all was the distinctness of detail in the spirals of the great "Island Universe" of the Hunting Dogs—that which Lord Rosse was first to see in 1845, and which, until the 20th century, was believed to be part of our own celestial continent. Delicate streamers from its two major spirals flowed far out into space, and the connection between the greater and lesser condensations could be clearly traced. The sight gave us a genuine thrill and no one seemed more absorbed, nor clung longer to the eye-piece than Dr. Shapley. "The man who remeasured the universe" was surely enjoying himself on this "night off." Dr. Douglass had established himself on the platform with his movie camera, and had placed a powerful studio light near at hand. Each observer was "shot" in turn as he assumed his seat at the eye-piece.

Mrs. Carpenter had invited us to her house for a cup of chocolate, so thither we repaired upon leaving the observatory. In her snug bungalow were all the evidences of house-wifely efficiency and good taste. Never was there brewed such chocolate before! The memory of its flavor and rich, creamy consistency still lingers. While it was being prepared, Dr. Carpenter showed us many of his stereoscopic slides—glass positives—which, as an ardent photographer, he has been making for some years. He delighted me with the suggestion of making stereo pictures with the ordinary camera. Two pictures of the same object or scene are taken, one at a slight angle from the other, the distance between taking positions varying directly with the mean distance of the subject. I have tried this repeatedly since with much success. It was close upon midnight when we drove Dr. Shapley to his train and sped him on his way to the Lone Star State.

On one afternoon toward the end of our stay, I met Dr. Douglass at his office by appointment. He was to tell me the story of his unique efforts to wrest knowledge from nature and to show me his store-house and laboratory. It proved to be an afternoon full of thrills and amazement, to which I cannot do justice in the telling. Dr. Douglass sat at the desk where I had first met him—a desk crowded with papers, data in notes and manuscript. Again as he discussed his hobby, there was apparent that air of virile activity, restrained energy, confidence and the power of concentration.

It was in 1901 that Dr. Douglass became inspired to examine and study the rings of old trees in the hope of finding in them some evidence of the influence of sun-spot cycles on tree growth. He reasoned that if drought conditions were, in a general way, coincident with sun-spot minima, this would be evidenced in the narrow ring bands to be looked for on cross sections of great trees for those determined periods. These he began measuring in 1904 and issued his first publication on the subject in 1909. In 1911, he was enabled, through the accumulation of material examined, to check the ring systems of many trees against each other, thus giving scientific value to his work. In 1919 appeared his first comprehensive treatise on the subject: Vol. I of "Climatic Cycles—Tree Growth." Vol. II was published in 1928. The blazing of new trails in science inevitably creates new terminology, and Dr. Douglass has called his research "Astroclimatology."

The work of such men as the late H. H. Turner and E. Walter Maunder, eminent English astronomers, in their terrestrial, astronomical, and historical investigations of sun-spot cycles, gave Dr. Douglass the opportunity to compare his data with those obtained from widely divergent sources. He showed me a letter which he had received from Mr. Maunder in 1922, stating that no evidence of sun spot activity could be found for the period from 1645 to 1715, and desiring to know if the tree rings showed the effect of this condition. Dr. Douglass had, at that time, found the evidence of the recurring sun-spot cycles in the pines of Arizona covering a period of 500 years, but had noted that the now

familiar cycles *did not appear* over one period of 75 years, the years from 1650 to 1725. One can well imagine his elation at receiving this remarkable corroboration of his conclusions.

In the *Journal of the B.A.A.*, Vol. XXXII, No. 4, 1921-22, page 140, Mr. Maunder tells of Dr. Douglass' findings. Since 1914, Dr. Douglass has forced from the yellow pines of Arizona the story of their ages and also those of very many of the ancient communal dwellings of the aborigines. His wondrous revelations are familiar to scientific men all over the world as well as to most laymen. The American Philosophical Society has published his reports, and the *National Geographic Magazine* for December, 1929, carried an illuminating article by Dr. Douglass called "The Secret of the Southwest solved by Talkative Tree Rings." Dr. Douglass finds no trees in Arizona older than 500 years, though the rings of some of the beams taken from ruined Indian homes show that these were cut 700 years ago. The redwoods of California, however, give evidence of great antiquity. The oldest specimen Dr. Douglass has found proclaimed itself to have been growing in 1300 B.C. Four others give their dates as 1100 B.C. Dr. Douglass believes that it is highly doubtful if any tree still living would prove to be older than the former. From the examination of many specimens, Dr. Douglass has evolved a perfect standard comparison scale against which to check the characteristic groupings of rings representing particular chronological periods. Upon this scale, as on all the specimens examined, the ring representing the year 1590 is so faint as to be almost negligible. How all growing things in the west must have cried for rain that year! It was the year shortly preceding the one in which Galileo discovered those mysterious spots upon the surface of the sun.

Later, we left the study with its wealth of printed and written records and went to visit the laboratory—a museum of original sources—wherein are housed the precious material from which these data were obtained. Across the campus we walked to the great building in which the students have their gym and locker-rooms, traversed narrow halls and descended stairs leading to a vast, dark basement apartment. There we encountered that multitudinous collection of beams, cross-sections of trees, wedge-shaped strips, cylindrical borings, and bits of charcoal, all labelled and catalogued and sorted into innumerable racks, bins, and cabinets for security and ready reference.

There were devices for counting and measuring the rings; long tables; overhead mirrors moved by ropes and pulleys; dark chambers into which one peered through strange oculars, to see wierd curves reflected from tilted gratings. To the uninitiate, they might have been instruments of ancient sorcery, instead of the tools employed by this modern wizard to wrest truth from trees.

Three instruments have been developed by Dr. Douglass to facilitate him in reading his results. The tubular borer, used to collect cylindrical cores from beams and trees; a recording microscope slide, or micrometer, for measuring ring widths, and the remarkable device which he calls

a "cycloscope," which enables him to determine readily the various periodic effects in a curve plotted from the diameters of the rings.

I sat in this darkened cellar with my eye at the peep-hole of a shrouded box, grasping the rim of a vertical wheel at my side. Before me was a tape marked with numerals, moving as the wheel turned. Actuated by the same wheel, was a sliding mirror which moved along the ceiling and caught the light which came through a long, perforated strip of cardboard. The mirror reflected this light to a cylindrical lens, through which it passed into the dark cabinet and fell upon a grating, which, in turn, reflected it to the eye of the observer. One may imagine how vague and mysterious it all seemed to the sluggish mind of the layman. But Dr. Douglass, standing at my side, was patiently explaining and instructing. One was at length made to understand that, by turning the wheel at one's side, thus moving both mirror and tape, those dots of light that covered the grating could be brought to align themselves parallel to a standard horizontal. Such an alignment being effected, one read from the tape, at a given spot, a number—4, 7, 9, 11, etc.—representing an annular climatic cycle which could later be translated into calendar years.

The wonder of it all—the revelations—are strongly impressed upon one's mind after a visit to this cavernous vault. Sadly enough, there is not adequate room in that place properly to care for the thousands of records or to arrange them conveniently for reference and examination, or to develop further the mechanical aids required to facilitate rapid and extended investigation.

Dr. Douglass sorely needs a filing gallery and a laboratory in keeping with his splendid purpose. A factory of grand proportions wherein to uncover the histories of past peoples and conditions, and to forecast, it may well be, the fat or lean years of the future, for the immeasurable benefit of a grateful race.

There came at last the day of parting—after a fortnight of pleasant comradeship and earnest intercourse. The Olcotts departed on a morning train for their favorite haunt in Florida. We were at the station to wish them God speed. Later in the day, we ourselves bade farewell to those genial friends whose hospitality will always be associated with memories of desert blooms, magic sunsets, and the glorious night sky of southern Arizona. We were bound northward where (at Flagstaff and the Grand Canyon) we were to be further impressed with the culture and beauty of that remarkable commonwealth.

SEPTEMBER 1, 1931.

SOLON IRVING BAILEY (1854-1931)

By EDWARD S. KING.

[*As originally planned this account of the astronomical work of Professor Solon I. Bailey was to appear in the preceding issue of "Popular Astronomy." Because of illness in his family and other unavoidable interruptions, the author was unable to complete the paper by that time. It was then agreed that the manuscript should be ready by September 10 which would be in time for the October issue. By a strange and most regrettable coincidence, on the date mentioned the information of the death of Professor Edward S. King, the writer of the biography, was received. Fortunately the manuscript was practically finished before the illness, which culminated in his death, rendered him incapable of carrying on his accustomed duties. The final revision, however, was made by him just two days before his death.*

As one reads this kindly, sympathetic, and beautiful tribute to the memory of a courteous, capable, and dignified gentleman by one of his colleagues, he becomes aware of the gentle nobility of the writer himself. His persevering efforts and the results he attained also form an important contribution to the rapid development of the science of astronomy during the present century.

We hope to be able to present a detailed account of his activities and his accomplishments to our readers in the near future. EDITOR.]

On June 5, 1931, Solon Irving Bailey, Phillips Professor of Astronomy, Emeritus, at Harvard University, died at Norwell, Massachusetts, in the seventy-seventh year of his age. He was a son of that grand state of which Daniel Webster declared, "In the mountains of New Hampshire God makes men." Born on December 29, 1854, at Lisbon, almost in the foothills of the White Mountains, his earliest vision fell on the rugged scenery, while the clean bracing air laid for him the foundations of vigorous health.

He was no less fortunate in his parentage. His father and mother, Israel C. and Jane Sutherland Bailey, were of sturdy English stock. Both brain and brawn marked this branch of the Bailey family. It is said that a grand-uncle was absorbed in mathematics, and devised a notable improvement in the numerical method of extracting cube roots.

When little Solon was five years old, his father left the Lisbon farm and located in Concord, New Hampshire. Here, with two brothers and a sister the boy grew to early manhood. Conditions at that time in New Hampshire fostered self-reliance, and with the quick ingenuity shown so frequently in later years, he turned his hand to many an odd job. An illustration of his remarkable readiness occurred at the solar eclipse of 1889. No mason being available, Bailey himself mastered the art of building the substantial piers for the instruments, much to the admira-

tion of his comrades.

It was not generally known, even by his associates, that Bailey had a fine artistic sense. He could do very creditable work with brush or pencil. Many letters to his small son are still extant, delightfully adorned with pen and ink sketches of events which occurred while he was traveling. This gift seemed innate from his youth and found early expression in crayon portraits sketched on faintly-delineated photographic enlargements made by Hinman, his older brother. The pair, working together with camera and crayon, found a profitable sale for their productions. These experiences aided in developing independence of character so that from the age of fifteen years he became financially responsible for his education.

After attending the high school in Concord, he entered Tilton Academy, graduating with the Class of 1877. Four years later he took his A.B. degree at Boston University. After graduation he returned to Tilton, as Headmaster, and remained there for three years, during which time he completed the requirements for the A.M. at Boston University, granted in 1884. In 1883, he married Ruth E. Poulter of Concord, who was teaching art at the Academy. Mrs. Bailey became a vital force in his life. She was a charming hostess, and was a professional as well as a social aid. She and their son, Irving W. Bailey, Professor of Plant Anatomy in Harvard University, survive him.

Bailey possessed a wonderful faculty for understanding people, young people in particular. He depended on reason and kindness in all his dealings and his spirit of fairplay appealed to his students. They called him "The Just Man." He won their respect and love so that no punishment was greater than his disapproval. In 1895, a former student of his at Tilton spoke publicly of him, as "always abundant in resources, intensely in earnest, original in thought and expression, unique in his methods, deserving the popularity he enjoyed."

Why Bailey, who enjoyed teaching and had achieved a notable success in his profession, should turn to astronomy is not entirely clear. It must have appealed strongly to his imagination. Perhaps his love of the stars began in 1866 when he witnessed the great meteor shower of that year. At any rate, the impression of the myriads of darting stars remained vivid in his memory throughout life. At Tilton he had conducted a class in astronomy and had showed the students celestial objects through a small telescope. Nevertheless his entrance into astronomy was somewhat fortuitous.

Wishing to obtain a degree from Harvard, he came with his family to Cambridge in 1887. Gravitating to the Harvard Observatory, he became a volunteer assistant, while engaged in studies leading to his degree of A.M., granted the following year. The Director, Professor Edward C. Pickering, recognized the worth and ability of the man, and, henceforth, Bailey's career was identified with the growth of the Observatory, particularly in the extension of its work in the Southern Hemisphere. It would seem that he did not choose astronomy, but that

astronomy chose him. Assistant in Astronomy from 1891-1892, he was made Assistant Professor in 1893, Associate Professor in 1898, and Phillips Professor in 1912. The last position he held until 1925, when he became emeritus. During the interval 1919-21 he was Acting Director at the Observatory.

The association begun in 1887 with Professor Pickering ripened into a very close and intimate friendship. The Director found in him an able and wise counsellor, who gave frankly his opinions, always well-considered with judicial care. Pickering could trust him and did trust him implicitly.

Bailey joined the Observatory at a time of rapid astronomical development. The photographic plate was supplanting the eye of the observer. Astrophysics gave intimations of marvellous advances in stellar knowledge. Pickering had already begun his work of intensive charting of the stars, and of the systematic photography of stellar spectra. A southern station became imperative for extending the Harvard Surveys of the sky to the South Pole of the heavens. Fortunately, the Observatory had just received the Boyden fund left without limitation for the purpose of establishing a station at an altitude where astronomical observations might be conducted to best advantage. After some preliminary tests of various localities, Bailey was asked to investigate the west coast of South America where great mountain altitudes might be attained with consequent dryness and clarity of the atmosphere. He went by way of California, stopping to observe the total solar eclipse of January 1, 1889. A month later he sailed from San Francisco with Mrs. Bailey and their small son, Irving, for Peru. At the Isthmus his brother, Marshall, joined him with apparatus brought from Cambridge.

They located provisionally at "Mount Harvard" near the town of Chosica, 12 degrees south of the Equator. The work was two-fold: visual and photographic. The 4-inch meridian photometer was used industriously, while the 8-inch Bache doublet photographed positions and spectra of southern regions. Meteorological and other instruments were also employed. Meanwhile, he visited Arequipa, the Atacama Desert in Chile, and other localities. Not only astronomical and climatic, but living conditions were weighed. At his recommendation Arequipa, at an elevation of 8000 feet above sea level, was chosen as the site for a permanent observatory. Undaunted by heights even more than double this distance upward, Professor Bailey in 1893 established a meteorological station on the summit of the volcano, El Misti, looming picturesquely 19,000 feet in the background of the Observatory. It was at the time the highest meteorological station in the world.

Professor W. H. Pickering with his family and two assistants arrived at Arequipa in January, 1891. The Baileys stayed on through the remainder of the cloudy season, assisting in the establishment of the station, and completing the observational program of the meridian photometer during clear nights in April and early May. On May 15, they returned to the United States by the Straits of Magellan and Europe.

Professor Pickering remained in charge of the station during the following two years. In 1893 Professor Bailey returned to Peru, and since that date the Harvard Southern Station at Arequipa was actually or virtually in his care until 1924. As the years passed, he alternated between Arequipa and Cambridge, his last visit to Peru being in 1922.

In Peru and on his various trips through tropical wilds, Bailey encountered many exciting situations, including rapids, earthquakes, a revolution, and a mild naval battle. He passed through all these vicissitudes with his usual alert serenity.

It is quite impossible to go into the details of his scientific work within the space allotted. One thinks first of his famous discoveries of variable stars in globular clusters, which furnished one of the initial steps in the extension of our knowledge of the structure and dimensions of our galactic system and the universes far outside. He followed hundreds of these "cluster variables," as he called them, through thousands of cycles, determining the periods to a tenth of a second. So precise were the methods that, if a photograph of such a cluster as Messier 3 had been buried at the foundation of the Pyramids, Professor Bailey, from a study of these variable stars, would have been able to fix the exact epoch when the photograph was made.

We should mention here that Bailey was a pioneer also in the photographic discovery of nebulae. Several thousands were found on the plates made with the Bruce telescope.

During 1919-21, while Acting Director at Cambridge, he inaugurated a systematic search for novae. Two observers were assigned the duty of examining the current photographic charts along the Milky Way, as soon as possible after they had been taken. In eighteen months fourteen novae had been identified, of which eight were unknown previously. From these results, he judged that ten or more novae as bright as the ninth magnitude, or brighter, appeared every year.

The excellent character of his photographic technique is shown by the plates which he made with the Bruce telescope, and his complete chart of the Milky Way is wholly unique.

Professor Bailey's administration of the Harvard South American Station was marked not only by scientific achievement but by most cordial relations with the Peruvian Government and people. Almost intuitively he understood their point of view. He entered most acceptably into the educated social circle of Arequipa, and made many warm friends. Of pleasing mien and dignified courtesy, he won their hearts with his sincerity. He spoke their language, and met them with a grace of manner as courtly as that of any Don of Spanish history.

Under his quiet demeanor Professor Bailey was a man of enthusiasms. He put his whole soul into the work at hand. Meteorology as related to elevation was an important feature in the work of the new station. In Peru, meteorology of this sort meant arduous scaling of lofty mountains, with the ever threatening spectre of mountain sickness. His companions, as one gentleman expressed it, learned "to appreciate

the calm, dignified, and sterling qualities of Professor Bailey" while under such trying conditions. In addition to the station on the summit of El Misti, he completed a chain of meteorological stations, starting from Mollendo at sea level, culminating on El Misti, and then passing beyond the Eastern Andes down to the valley of a great tributary of the Amazon. The results accruing from nearly ten years' maintenance of these stations form a unique chapter in meteorology.

Bailey was a delightful raconteur whenever a group could persuade him to talk, yet he spoke of his adventures as if they were nothing out of the ordinary. Some of his most interesting experiences were connected with a trip over the Andes down to the plain of the Amazon. A portion of the route had been traversed but once previously by a white man. In the wilds he met savages who dressed chiefly when receiving visitors but who were surprisingly intelligent, and keen to appreciate anything in the way of a joke.

Leaving the railway on the Titicaca Plateau, it became necessary for his party to resort to mule-back in order to cross the Eastern Cordillera and surmount the Andes. Four or five days were required to attain Aricoma Pass at 16,500 feet above sea level, where the traveller might be rewarded by the sight of snow-capped mountains, colorful glaciers, and lakes, but he also frequently encountered the terrors of blinding snowstorms and mountain sickness. The penalty of losing one's way was death. But reaching the eastern crest of these mountains on a clear day, Bailey said, one seemed to be standing on the edge of the world. The ground drops off abruptly, and at one's feet are seemingly bottomless "gorges, deep ravines in whose gloomy depths rage the torrents which fall from the snowy summits of the Andes." Only occasionally does the sun penetrate the deluge of rain and mist.

Stepping almost literally "down stairs," he reached the "rubber country." The remainder of the trip was made by water with a reconnaissance party of the Inca Rubber Company. Mr. Chester W. Brown, general manager of the company and chief of the expedition, says that Bailey was a most congenial member of the party. His lack of experience in tropical wilds was compensated for by his ready adaptability. "In the many close encounters which he had with rapids and various other difficulties, he was always calm and collected and his presence helped out the expedition to a great extent."

In recent years South Africa has been the Mecca for the establishment of branch stations of northern observatories. Bailey was a pioneer in this field. Sent out in 1908 by the Director, he spent a year in studying and appraising the relative advantages offered. From his long experience, observational and otherwise, he was most competent to perform this mission. His report was specific and favorable; unfortunately the Observatory was at that time without funds to effect the transfer of the Arequipa Station. However, Bailey's work blazed the trail for others, and eventually for Harvard.

As he was about to leave for this expedition to South Africa, Presi-

dent Eliot of Harvard at a luncheon likened Bailey to a foreign ambassador, though without portfolio. And so it proved. In England he lunched, as guest of honor, with United States Ambassador and Mrs. Whitelaw Reid; he was in consultation with Sir David Gill and Sir William Morris, and met other prominent men of science. During his brief stay in England he received the courtesies of several observatories. At Cape Town, he was cordially welcomed; was dinner-guest of Sir Walter Hely-Hutchinson, Governor of the Colony, who with other officials were of great assistance. It was everywhere the same with him, whether on the West Coast of South America, in London, or Hamburg, in Cape Town, or on the high veldt; his affability and sincerity opened the doors to a mutual understanding. Nor, in his own country, was he a prophet without honor.

Professor Bailey reecived many honors at home and abroad. He was a member of the National Academy of Sciences, the American Academy of Art and Sciences, the American Astronomical Society, the Royal Astronomical Society (Associate), the Astronomische Gesellschaft, the International Astronomical Union, and of many other groups of scientists and scholars. He was also a delegate to the Second Pan-American Scientific Congress held at Washington, D. C., in 1925. Love and repect for Bailey in Peru impelled the Arequipians to honor him, in 1923, with the degree of Doctor of Science and the title, Professor of Astronomy, in the ancient University of San Augustin.

Professor Bailey was universally liked. During the period 1919-21, when he was Acting Director of the Observatory, his relations with the staff were peculiarly intimate. Even previously, members had looked to him for counsel and advice. When he made his last visit to Peru, the staff assembled as a body and gave him tokens of their love and regard.

At his retirement in 1925, Professor Bailey did not hang up his armor or lay aside his arms. All the more eagerly he attacked work which now he could follow leisurely without routine distractions. Before his death he had completed two notable works: the concluding installment in the *Harvard Annals* of "Peruvian Meteorology," and his "History and Work of Harvard Observatory." The final checking of the meteorological tables would be a formidable task for any one without his power of concentration and patience. As he once remarked, "I can lose myself in the thing I am doing." In correcting single errors he studied the psychological source of each, so as to locate all errors of similar character. This number of the *Annals* appeared several weeks after his death.

None other was so well fitted for producing the "History," or could have described so faithfully events in which he himself had had such a large share for the past forty-four years. Here with a deft hand he has intertwined the development, the work, and the characters of the Observatory from the beginning—a comprehensive study, but outlined with accuracy, vividness, and humor, so that the completed portrait stands before us. His brief word-sketches of the leading staff-members

are remarkable in giving a clear, kindly, but truthful tribute to each. How modestly he has spoken of his own work, only those acquainted therewith can appreciate.

After his retirement, he engaged in other important investigations. Recently, he had resumed the study of the periods of cluster variables, and had laid extensive plans for other work. Several sheets were found among his papers, outlining studies he hoped to accomplish, a list sufficient to occupy years of labor.

Professor Bailey was a graceful writer, not only in the narrative portion of the *Harvard Annals,* but in his popular articles. His style is clear, concise, and convincing. Recently, his "Astronomical Interlude," a pleasing account of the personnel and activities of the early Nautical Almanac Office in Cambridge, attracted much attention.

He was a charming conversationalist, and had a way of summing up a situation in a delightful aphorism. He looked at life squarely. He could smile at human foibles, yet meet them generously. In discussions, he appreciated the opposite standpoint almost too well for his own interests, yet his convictions were not to be shaken; truth was everything to him. He received a new concept with an open mind.

Unknown perhaps to many, he possessed a deeply religious spirit. In time of sorrow, his words of comfort were as satisfying as those of a mother. He was sympathetic with the beliefs of others. His attitude to man and the universe is expressed in the conclusion of one of his radio talks: "Man may be, as has been claimed, only the latest development of the whirling star mist, but the fact that he has intelligence enough to trace his own evolution, stands unexplained, except by the presence in Nature of an intelligence far superior to his own."

He was democratic in his tastes, but he loved the contrasts in life. For example, having attended a formal dinner in immaculate evening dress he derived the greatest pleasure next morning in seeking the "Farm," his summer home at Norwell, Massachusetts, where with tattered hat, possibly the remains of a priceless Panama of Peruvian days, and garments old, but worn with dignity, he might be seen with axe or hoe or barrow attending the many details of the place he loved so dearly. He frequently spoke of renewing his strength from the soil.

Here at the "Farm," amid the beauty of flower and foliage which he had so carefully tended, he passed beyond.

Those who have known him as the courteous gentleman, the genial host, the understanding friend, the wise counsellor, and wholly delightful comrade will sorely miss the inspiration of his great soul.

SEPTEMBER 1, 1931.

PLATE XI

SOLON IRVING BAILEY
1854-1931

PHOTOMETRIC AND VISUAL SCALES OF MAGNITUDE

By R. H. TUCKER.

The photometric scale of star magnitudes was based originally upon established scales of brightness from visual observations. These began with the earliest naked eye attempts to distribute the bright stars on a consistent scheme. From the approximate separation into single units of magnitude, first to sixth, the various Uranometries divided the stars into fractions of single units, at first halves, then quarters and finally tenths.

With the use of the telescope the old visual scale of magnitudes was extended to fainter stars, roughly from sixth to ninth. These two types became quite definitely fixed for visual magnitudes, type six at about the limit of naked eye vision, and type nine at the limit adopted for complete enumeration of the stars in the original Durchmusterung or census of the sky. Later efforts may be described as the grading of stars between these types, and also extending the grading above and below them.

Photometric measures have a similar objective, an extended and accurate grading of the stars on a consistent scale from the bright to the faint limit. The old or so-called Historic scale for the bright stars has been presumed to be based upon a unit light ratio of 2.3. That is any grade of star is 2.3 times as brilliant as a grade one unit of magnitude fainter. A range of six units would make the brightest star about one hundred times as brilliant as the faintest star visible to the naked eye. The so-called Normal scale has the unit light ratio of 2.5, and a range of five units of magnitude on this scale would correspond nearly to one hundred times the brilliancy. The fainter stars have been generally graded nearly according to the Normal scale.

Photometric observations have been designed largely to harmonize the variations in the visual scale. The personal factor is present in either scheme, since photometric measures involve the test of the equality of two star-images, one of which may be an artificial one. Visual scales generally depend upon the differences in brilliancy, which may be arranged to proceed by steps of small size between stars of nearly the same brightness.

The recently printed San Luis catalogue includes all stars to 6.9 in the area between —20° declination and the south pole. This is about 66 per cent of the southern sky. The magnitudes are on a photometric scale, either adopted from those compiled at the Harvard Observatory, or from special photometric observations made at San Luis. Many fainter stars were also included that had been observed earlier than 1875, thus providing a good basis for the computation of proper motions.

The Cordoba General Catalogue was observed and printed a genera-

tion earlier. Its magnitudes are on the visual scale, taken from the Cordoba Uranometry to seventh magnitude, and from the visual estimates of the meridian observers for fainter stars. The Cordoba catalogue includes nearly all stars between —22° and the south pole that had been observed earlier, so that these catalogues have some similarity in design. About nine-tenths of the San Luis stars are in the Cordoba General Catalogue, and the remainder were generally observed in the Cordoba Zones. The Cordoba General Catalogue includes in all over twice as many stars as are contained in the San Luis Catalogue. The comparison of the magnitudes of the two catalogues is an illustration of the relation between photometric and visual scales. The first twelve hours of right ascension are summed up here.

The following table gives the numbers of stars at the individual grades of magnitude on the San Luis standard, and the mean magnitudes of the same stars from Cordoba. The first group includes those brighter than 2.0 San Luis, the second group includes those from 2.0 to 2.9, and the last group those fainter than 9.0 San Luis. The differences show a variation which is due to an inconsistency in the magnitude scale of one or both authorities. The San Luis estimates are about one-tenth brighter than those of Cordoba for the brightest stars, this difference increases to above four-tenths for fifth-magnitude stars, then diminishes to approximate equality at eighth magnitude, and the San Luis estimates are more than two-tenths fainter at ninth magnitude. Both catalogues include some stars of tenth magnitude.

TABLE I.

SAN LUIS MAGNITUDES.

S.L.	Cor.	Diff.	Stars	Sum	Ratio	Comp.	O. — C.
1.32	1.46	—14	6				
2.45	2.63	—18	16	22			
3.0	3.10	—10	3	25		3	0
1	3.30	—20	2	27		3	— 1
2	3.27	—07	4	31		3	+ 1
3	3.38	—08	4	35		4	0
4	3.26	+14	5	40		4	+ 1
5	3.30	+20	2	42		5	— 3
6	3.66	—06	7	49		6	+ 1
7	3.89	—19	8	57		6	+ 2
8	3.84	—04	9	66		7	+ 2
9	4.02	—12	9	75	3.41	8	+ 1
4.0	4.00	00	9	84	3.36	9	0
1	4.27	—17	17	101	3.74	10	+ 7
2	4.42	—22	10	111	3.58	11	— 1
3	4.40	—10	9	120	3.43	13	— 4
4	4.69	—29	22	142	3.55	14	+ 8
5	4.80	—30	25	167	3.98	16	+ 9
6	4.93	—33	19	186	3.80	18	+ 1
7	5.11	—41	15	201	3.53	20	— 5
8	5.20	—40	23	224	3.39	23	0
9	5.31	—41	30	254	3.39	26	+ 4
5.0	5.44	—44	35	289	3.44	29	+ 6
1	5.55	—45	39	328	3.25	33	+ 6
2	5.64	—44	47	375	3.38	37	+10

S.L.	Cor.	Diff.	Stars	Sum	Ratio	Comp.	O. — C.
3	5.71	—41	47	422	3.52	41	+ 6
4	5.84	—44	62	484	3.41	46	+16
5	5.87	—37	52	536	3.21	52	0
6	5.99	—39	66	602	3.24	59	+ 7
7	6.18	—48	62	664	3.30	66	— 4
8	6.22	—42	86	750	3.35	74	+12
9	6.34	—44	65	815	3.21	84	—19
6.0	6.46	—46	99	914	3.16	94	+ 5
1	6.49	—39	102	1016	3.10	106	— 4
2	6.61	—41	110	1126	3.00	119	— 9
3	6.71	—41	128	1254	2.97	134	— 6
4	6.77	—37	162	1416	2.93	151	+11
5	6.84	—34	157	1573	2.93	170	—13
6	6.94	—34	189	1762	2.93	191	— 2
7	7.00	—30	198	1960	2.95	215	—17
8	7.08	—28	241	2201	2.93	242	— 1
9	7.14	—24	247	2448	3.00	272	—25
7.0	7.26	—26	295	2743	(3.00)	(305)	(—10)
1	7.31	—21	240	2983			
2	7.42	—22	331	3314			
3	7.45	—15	266	3580			
4	7.58	—18	288	3868			
5	7.66	—16	299	4167			
6	7.70	—10	331	4498			
7	7.73	—03	250	4748			
8	7.83	—03	264	5012			
9	7.86	+04	207	5219			
8.0	7.97	+03	261	5480			
1	8.05	+05	202	5682			
2	8.06	+14	159	5841			
3	8.19	+11	132	5973			
4	8.27	+13	151	6124			
5	8.38	+12	125	6249			
6	8.46	+14	102	6351			
7	8.52	+18	66	6417			
8	8.57	+23	61	6478			
9	8.67	+23	48	6526			
9.0	8.78	+22	41	6567			
9.45	9.14	+31	178	6745			

The numbers of stars of each grade, and the consecutive summations afford an internal and independent test of the scale of magnitude. Based upon the assumption that stars of all classes of intrinsic brightness are distributed nearly uniformly in space, the summations should have a nearly constant ratio per unit of magnitude. The ratios, however, decrease progressively, within the usual accidental deviations, from about 3.6 in the first group of ten summations to 3.0 at magnitude 6.9, the limit of the complete enumeration of stars.

These summations can be translated into equivalent light ratios, since the number of stars in a sphere of space varies directly with the cube of the radius of the sphere, and the brightness of the star varies inversely with the square of its distance. The corresponding unit light ratios decrease from 2.4 to 2.1, over the range covered by these summations of stars. The seventh column gives the number computed for each grade with the uniform value 3.25 for the summation ratio, derived from the summations at 2.9 and 6.9 San Luis. This corresponds with

TABLE II.

CORDOBA MAGNITUDES.

Cor.	Stars	Sum	Ratio	Comp.	O. — C.
To 1.9	4				
2.0 to 2.9	18	22			
3.0	2	24		3	— 1
1	2	26		3	— 1
2	5	31		3	+ 2
3	4	35		4	0
4	4	39		4	0
5	7	46		4	+ 3
6	5	51		5	0
7	4	55		6	— 2
8	5	60		6	— 1
9	11	71	3.23	7	+ 4
4.0	8	79	3.29	8	0
1	9	88	3.38	9	0
2	8	96	3.10	10	— 2
3	7	103	2.94	11	— 4
4	11	114	2.92	12	— 1
5	12	126	2.74	14	— 2
6	9	135	2.65	15	— 6
7	15	150	2.73	17	— 2
8	15	165	2.75	19	— 4
9	12	177	2.49	21	— 9
5.0	18	195	2.47	24	— 6
1	13	208	2.36	27	—14
2	21	229	2.39	30	— 9
3	32	261	2.53	33	— 1
4	33	294	2.58	37	— 4
5	33	327	2.60	42	— 9
6	41	368	2.73	47	— 6
7	59	427	2.85	52	+ 7
8	57	484	2.93	58	— 1
9	58	542	3.06	65	— 7
6.0	69	611	3.13	73	— 4
1	52	663	3.19	81	—29
2	66	729	3.18	91	—25
3	85	814	3.12	101	—16
4	115	929	3.16	114	+ 1
5	132	1061	3.24	126	+ 6
6	154	1215	3.30	142	+12
7	186	1401	3.28	158	+28
8	193	1594	3.29	177	+16
9	284	1878	3.46	197	+87
7	589	2467	(4.04)	(221)	(+368)
7¼	762	3229		(672)	(+ 90)
7½	885	4114		(888)	(— 3)
7¾	718	4832			
8	814	5646			
8¼	349	5995			
8½	388	6383			
8¾	135	6518			
9	132	6650			
9¼	36	6686			
9½	32	6718			
9¾	11	6729			
10	16	6745			

2.2 for the mean light ratio of this photometric scale. The eighth column gives the differences, observed minus computed, at each grade. The average of the numbers recorded at the even tenths exceeds the average at the odd tenths. The zeros are not in excess. The grade 7.0 San Luis would seem to be well represented with this ratio. The grades fall off in numbers beyond that point. The average O. — C. is slightly less than 6 stars.

The Cordoba scale of magnitudes can be similarly tested by its counts of stars. The second table gives the distribution of the same stars on the Cordoba standard, by tenths to 6.9, and by quarters below that grade. The ratios increase from about 2.9, in the first group, to 3.2 in the last group of ten. The increase is not uniformly progressive, since the average ratio of the second group is lower than that of the first group of ten. This decrease accounts for the peak in the comparison of the mean magnitudes of the two catalogues.

The computed numbers in the fifth column are derived with a uniform summation ratio of 3.04, from the summations at 2.9 and 6.9 Cordoba. This corresponds to a mean light ratio 2.1. The average of the numbers at odd tenths is in excess of the average at even tenths, but this is entirely due to the large excess at grade 6.9. It would seem from the sixth column that stars to grade 7½ Cordoba are represented with this uniform ratio. The grade 7 is largely in excess, corresponding to the point at which the naked eye magnitudes of the Uranometry are replaced by the meridian telescope observations. The average of the O. — C. column is 8 stars. Excluding the large excess at grade 6.9 the average of the numbers recorded at the even tenths exceeds the average is 3.88, which corresponds with the light ratio 2.5 of the Normal scale of magnitudes for faint stars. The change in light ratio evidently begins at grade 6.4 Cordoba.

To sum up the results of this comparison, the accepted theory of distribution according to magnitude shows that the light ratio of this photometric scale decreases progressively. The visual scale, as represented in the Cordoba General Catalogue, has a depression in its general increase of light ratios. The systematic divergence of the two scales appears to continue down to the faint limit beyond ninth magnitude.

PALO ALTO, JANUARY, 1931.

THE ATHLETE

Night is an athlete.
His sinews ripple
In chasing furrows
Which sunsets stipple
The while he, bending,
Hurls the moon discus
Cleanly, sending
It high on its arc.
When Day flees the dark
He juggles the stars,
Tossing them up through
His gleaming black hair.
Sometimes he misses,
And the far fall mars
And shatters the balls.
Weary of toying,
Fragile enjoying,
He challenges Dawn
To a skyey race;
First touching the goal
At the western rim,
And leaving the course
With the victor's grace.

—FRANCES B. HUSTON.

PLANET NOTES FOR NOVEMBER, 1931

By CLIFFORD E. SMITH.

The *Sun* will be moving southeast from the western part of Libra to the central part of Scorpio. The position of the sun on the first and last days of the month will be, respectively:

R.A. $14^h\ 21^m$, Decl. $-14°\ 3'$; R.A. $16^h\ 20^m$, Decl. $-21°\ 27'$.

The phenomena of the *Moon* will occur as follows:

Last Quarter	Nov.	3 at	1 A.M.	C.S.T.
New Moon		9 "	5 P.M.	"
First Quarter		16 "	8 P.M.	"
Full Moon		25 "	1 A.M.	"
Perigee		8 "	9 A.M.	"
Apogee		20 "	11 A.M.	"

Mercury will be an evening star of magnitude about minus one-half, and it will be moving with an apparent easterly motion from the central part of Libra, across Scorpio, to the eastern part of Ophiuchus. At the beginning of the month Mercury will set about a half hour after the sun, but by the end of the month it will set an hour and a half after the sun. The distance of the earth from Mercury at the beginning of the month will be about 130 million miles, and its distance will decrease about 40 million miles during the month. During this period the apparent disc of Mercury will be between five and six seconds of arc in diameter. On November 10 conjunction with the moon will occur, and on November 21 there will be a conjunction with Mars.

Venus will be a morning object of brightness about magnitude minus three, moving from eastern Libra, across Scorpio, to eastern Ophiuchus. Its distance from the earth will decrease, during this period, from about 153 million to about 145 million miles. The apparent diameter of the disc of Venus will be slightly greater than ten seconds of arc. Conjunction with the moon will occur on November 11, and conjunction with Mars on November 19. During the middle of the month Venus will rise about an hour before the sun.

Mars will be an evening object in Scorpio and Ophiuchus setting about an hour after the sun. Its distance from the earth will be about 220 million miles. Conjunction with the moon will occur on November 11. On that date Venus is also in conjunction with the moon. There will be a conjunction with Venus on November 19, and one with Mercury on November 21.

Jupiter will be a morning object of magnitude about minus two in western Leo. Its apparent motion will be direct, and it will be on the meridian about 6:00 A.M. since quadrature west of the sun will occur on the fifteenth. It will be in conjunction with the moon on November 4. The apparent diameter of Jupiter will be about 35 seconds of arc, and its distance from the earth will be about 480 million miles.

Saturn will be an early evening object in northern Sagittarius of magnitude about plus one. At the end of the month it will set about three hours after the sun. Its distance from the earth will be about 980 million miles, and the apparent diameter of the disc of the planet proper will be about 14 seconds of arc. Conjunction with the moon will occur on November 14.

Uranus will be in eastern Pisces, and its apparent motion will be retrograde. The distance of Uranus from the earth will be about 1800 million miles, and the apparent diameter of its disc will be about 3½ seconds of arc. Uranus will be on the meridian about 9^h 30^m P.M. during the middle of the month. Conjunction with the moon will occur on November 21.

Neptune will be in Leo about three degrees from ρ Leonis, and its apparent motion will be direct. At the end of the month it will be on the meridian about 6:00 A.M. since quadrature west of the sun will occur on December 1. Its distance from the earth will be about 2800 million miles, and its apparent diameter will be about 2½ seconds of arc. Conjunction with the moon will occur on November 5.

Ephemeris of Pluto for November 1, 1931, to March 1, 1932.—The accompanying ephemeris of Pluto is based on elements by Nicholson and Mayall, published in the January, 1931, number of the *Astrophysical Journal*. I computed elements of the orbit of Pluto but they are not good. They are based upon positions of 1930 *only*, and the arc (heliocentric) was so small that the resulting elements were not satisfactory. The heliocentric arc from November 1, 1931, to March 1, 1932, is only 0° 24′ 43″.88. The next opposition will take place on January 12, 1932.

1931 U.T.		α	δ	Log. r	Log. Δ
		h m s	° ′ ″		
Nov.	1	7 35 55	+22 4 8	1.611634	1.608694
	9	7 35 45	+22 5 10	1.611579	1.607251
	17	7 35 29	+22 6 20	1.611524	1.605885
	25	7 35 6	+22 7 46	1.611469	1.604625
Dec.	3	7 34 39	+22 9 26	1.611409	1.603494
	11	7 34 5	+22 11 14	1.611357	1.602524
	19	7 33 28	+22 13 11	1.611303	1.601731
	27	7 32 48	+22 15 14	1.611248	1.601131
1932					
Jan.	4	7 32 5	+22 17 21	1.611192	1.600734
	12	007 31 22	+22 19 28	1.611137	1.600552
	20	7 30 38	+22 21 34	1.611081	1.600588
	28	7 29 55	+22 23 37	1.611026	1.600838
Feb.	5	7 29 14	+22 25 33	1.610970	1.601295
	13	7 28 36	+22 27 21	1.610915	1.601947
	21	7 28 2	+22 28 59	1.610859	1.602777
	29	7 27 32	+22 30 26	1.610805	1.603767

FRANK E. SEAGRAVE.

North Scituate, (R. I.), Observatory, March 28, 1931.

OCCULTATIONS

OCCULTATIONS VISIBLE IN LONGITUDE +72° 30′, LATITUDE +42° 30′.
(Contributed by the office of the *American Ephemeris*.)

Date 1931		Star	Mag.	IMMERSION Greenwich C.T.	IMMERSION a	IMMERSION b	IMMERSION Angle E from N	EMERSION Greenwich C.T.	EMERSION a	EMERSION b	EMERSION Angle E from N
				h m	m	m	°	h m	m	m	°
Nov.	2	ω Cnc	6.1	5 11.9	+0.3	+3.5	43	5 51.1	−1.5	−1.4	330
	2	4 Cnc	6.2	5 26.4	−0.8	+0.7	112	6 33.4	−0.9	+1.5	262
	14	A Sgr	4.9	20 20.8	..	..	13	21 4.5	..	..	313
	17	182 B.Aqr	6.2	20 59.2	−0.6	+2.8	3	21 48.4	−2.6	+0.2	293
	25	27 Tau	3.7	1 5.0	+0.8	+3.8	6	1 44.1	−2.5	−0.3	300
	26	107 B.Aur	6.5	22 45.1	+0.5	+1.2	77	23 37.7	+0.2	+1.3	260
	29	c Gem	5.5	3 35.2	−0.9	+0.7	111	4 43.0	−1.0	+1.5	259

OCCULTATIONS VISIBLE IN LONGITUDE +91°, LATITUDE +40°.

Date 1931	Star	Mag.	IMMERSION Greenwich C.T. h m	IMMERSION a m	IMMERSION b m	IMMERSION Angle E from N °	EMERSION Greenwich C.T. h m	EMERSION a m	EMERSION b m	EMERSION Angle E from N °
Nov. 2	4 Cnc	6.2	5 16.8	—0.1	+1.0	98	6 17.2	—0.4	+1.2	272
12	W Sgr	4.3	23 45.5	—2.4	—2.8	141	0 20.3	+0.6	+1.2	201
13	183 B.Sgr	6.2	23 50.2	..	..	133	0 27.0	..	..	192
20	80 B.Psc	6.3	3 54.0	..	..	124	4 19.6	..	..	156
22	π Psc	5.6	9 17.3	—0.5	+1.7	17	9 55.7	+0.4	—2.8	298
24	104 B.Tau	5.5	23 55.1	—0.4	+1.0	110	0 36.4	+0.6	+2.5	200
29	c Gem	5.5	3 24.1	—0.1	+1.1	96	4 25.5	—0.4	+1.2	269

OCCULTATIONS VISIBLE IN LONGITUDE +120°, LATITUDE +36°.

Nov. 2	λ Cnc	5.9	15 13.6	—1.6	—1.2	106	16 27.4	—0.8	—2.2	309
6	β Vir	3.8	11 49.1	—0.4	+0.5	111	12 48.8	—0.6	—0.4	313
16	χ Cap	5.3	5 0.1	—1.1	—1.0	86	5 58.9	+0.2	+0.7	211
20	80 B.Psc	6.3	2 33.3	—1.7	+1.8	54	3 59.2	—1.4	+1.8	218
21	147 B.Psc	5.9	3 28.0	—2.5	+1.1	81	4 39.4	—0.6	+2.8	192
22	π Psc	5.6	8 49.6	—1.1	+1.2	36	9 57.0	—0.9	—1.3	267
23	19 Ari	5.8	1 2.4	—0.6	+1.2	98	1 50.2	+0.2	+2.6	196
26	38 B.Aur	6.5	12 8.8	—2.1	+1.5	39	12 53.4	+0.2	—3.7	323
27	406 B.Tau	5.6	4 55.7	—1.2	+0.3	117	5 48.3	—0.1	+2.8	217
29	4 Cnc	6.2	12 32.8	—2.2	—0.4	88	13 43.8	—0.7	—2.7	322

The quantities in the columns *a* and *b* are given for the purpose of making these predictions useful for any place within 200 miles of the point indicated. The procedure is as follows: Subtract the longitude of the point given from the longitude of the place in question; multiply the result, taking the signs into account, by the quantity under *a* for the star to be observed; similarly, with the latitude, using *b*; apply the sum of the products, with its proper sign, to the Greenwich C.T., and obtain the predicted Greenwich Civil Time for the phenomenon at the place of observation. To obtain Eastern Standard Time it is necessary to subtract five hours; Central Standard Time, six hours, etc.

VARIABLE STARS

Monthly Report of the American Association of Variable Star Observers for July and August, 1931

In spite of the excessively cloudy weather reported from most observing stations, the total number of observations listed is not greatly below that for corresponding months in previous years. Fifty-four observers are included in this report, more than for many months past. The good work of Mr. D. B. Pickering is reflected, not in the number of observations which he has contributed, but in the receipt of initial contributions from some of our new West Coast members, Messrs. Beery, A. Hildom and L. Hildom. Mrs. Elizabeth Buckstaff also contributes her maiden list, as do Messrs. Kohman, Jansen, Simpson, and Stearns. After some years of quietude, we have short lists from Messrs. Cilley, Olcott, Sanders, and Zaldo, and we are pleased to welcome all of these to our list of "actives."

Mr. Pickering is back at his home in East Orange after seven months spent visiting professional and amateur astronomers not only in this country, but Hawaii

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

June 0 = J.D. 2426493; July 0 = J.D. 2426523; August 0 = J.D. 2426554.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
X AND			α CAS			W CAS			X CAS			T PER			RR CEP		
001046			003656			004958			014958			021258			022980		
517	9.8	Fd	521	2.3	Mc	569	11.7	Fd	505	11.0	Bn	520	8.7	Ah	561	[13.7	Br
534	10.5	Fd	522	2.5	Mc	U TUC			506	12.0	Jo	527	8.6	Jo	R TRI		
555	11.6	Jo	524	2.6	Mc	*005475*			510	11.8	Jo	529	9.3	Fd	023133		
559	11.5	Jo	525	2.7	Mc	469	9.7	Sl	510	11.9	Bn	534	8.8	Jo	505	7.0	Jo
T CET			528	2.2	Mc	473	10.0	Bl	514	11.8	Jo	539	8.5	Jo	510	6.9	Jo
001620			529	2.3	Mc	474	10.3	Ht	517	12.0	Jo	545	8.5	Jo	514	6.8	Jo
541	6.2	L	531	2.2	Mc	478	10.1	Ht	517	11.8	Bn	546	8.4	Pt	516	6.8	Ad
T AND			532	2.3	Mc	484	10.8	Sl	518	12.6	Pt	547	8.7	Ah	518	6.8	Pt
001726			533	2.5	Mc	484	10.3	Bl	534	12.2	Jo	555	8.5	Jo	518	6.7	Ah
517	[12.6	Fd	535	2.5	Mc	486	11.2	Ht	539	12.1	Jo	Z CEP			520	6.8	Ah
535	12.5	Jo	535	2.3	Ko	495	11.4	Sl	539	12.3	Bn	021281			523	6.6	Ah
539	12.2	Jo	537	2.6	Ko	495	11.7	Bl	545	12.0	Jo	518	12.0	Pt	534	7.0	Fd
545	12.0	Jo	537	2.4	Mc	499	11.5	Sl	545	12.6	Pt	527	11.2	Br	534	6.7	Jo
558	12.0	Jo	538	2.6	Ko	505	11.9	Sl	554	11.8	Jo	544	10.5	Br	539	6.7	Jo
T CAS			539	2.7	Ko	Z CET			559	11.8	Jo	546	10.8	Pt	545	7.0	Jo
001755			540	2.2	Mc	*010102*			U PER			555	10.5	Br	546	6.5	Pt
505	11.2	Mc	541	2.7	Ko	541	10.7	L	015254			o CET			547	6.9	Ah
505	12.0	Jo	544	2.5	Ko	545	11.2	Pt	518	10.4	Pt	*021403*			558	7.4	Jo
506	11.8	L	544	2.3	Oy	U AND			531	9.4	Mc	383	9.4	Mn	564	7.4	Ad
508	11.4	Mc	545	2.5	Ko	010940			534	9.6	Fd	507	4.3	Sl	564	7.7	Fd
510	12.2	Jo	547	2.7	Ko	506	[13.0	L	535	9.1	Mc	541	6.1	L	W PER		
517	11.8	Ch	548	2.5	Ko	534	[12.0	Fd	535	10.0	Jo	545	6.0	Jo	024356		
518	12.0	Pt	548	2.3	Oy	541	14.5	L	537	8.7	Mc	546	6.2	Pt	505	9.9	Mc
527	12.2	Jo	550	2.2	Oy	UZ AND			539	9.8	Jo	565	7.4	Ad	506	9.0	Jo
530	11.9	Sj	551	2.1	Ko	011041			540	8.8	Mc	S PER			510	9.2	Jo
535	12.5	Jo	552	2.5	Ko	506	[13.9	L	545	9.5	Jo	021558			514	9.0	Jo
539	12.5	Jo	554	2.5	Ko	517	[13.9	Ma	546	9.5	Pt	506	8.5	Jo	517	9.0	Jo
541	12.0	L	U CAS			S PSC			549	9.5	Jo	509	9.6	Ah	518	8.8	Pt
545	12.0	Pt	004047			011208			569	8.9	Mc	510	8.4	Jo	527	9.0	Jo
545	12.3	Jo	506	14.2	L	541	10.1	L	S ARI			517	8.5	Jo	528	9.1	Ws
554	11.9	Jo	541	14.4	L	553	10.2	L	015912			518	9.7	Pt	531	9.9	Mc
556	11.9	Bg	V AND			S CAS			541	13.9	L	520	9.5	Ah	534	9.4	Jo
558	11.8	Jo	004435			011272			R ARI			527	8.5	Jo	534	9.0	Fd
559	12.3	Sj	506	9.6	L	433	[13.0	Bg	021024			529	9.5	Fd	535	10.0	Mc
574	12.1	Sj	541	9.8	L	529	[12.3	Fd	517	8.3	Fd	534	8.5	Jo	537	10.2	Mc
R AND			— CAS			U PSC			518	8.6	Pt	539	8.3	Jo	539	9.0	Jo
001838			004746b			011712			528	8.0	Ws	545	8.4	Jo	540	10.3	Mc
417	12.0	Ma	545	11.0	Pt	541	13.4	L	534	7.9	Fd	546	9.9	Pt	545	9.0	Jo
418	12.2	Pt	W CAS			545	12.8	Pt	541	7.5	L	547	9.7	Ah	546	9.1	Pt
534	[12.3	Fd	004958			RZ PER			546	8.1	Pt	555	8.5	Jo	558	9.0	Jo
545	12.7	Pt	506	10.7	Jo	012350			547	8.1	Ah	R CET			564	9.8	Fd
557	[12.6	Fd	509	11.0	Ah	500	13.4	L	560	7.9	Fd	*022000*			569	10.2	Mc
S TUC			510	10.7	Jo	541	13.1	L	569	8.2	Fd	541	9.1	L	R HOR		
001862			514	11.0	Jo	RU AND			W AND			RR PER			*025050*		
473	8.2	Bl	517	11.4	Jo	013238			021143a			022150			469	6.1	Sl
484	8.3	Bl	517	11.5	Fd	506	12.5	L	518	7.2	Pt	506	13.5	L	473	6.5	Bl
495	8.3	Bl	518	11.5	Pt	517	12.3	Ma	521	7.4	Ah	543	13.6	L	484	6.0	Bl
S CET			527	11.8	Jo	534	11.6	Fd	545	7.8	Jo	U CET			495	6.5	Bl
001909			529	11.4	Fd	543	11.7	L	546	7.6	Pt	*022813*			T HER		
541	11.9	L	534	11.5	Jo	545	11.1	Pt	547	8.8	Ah	541	11.6	L	*025751*		
545	11.8	Pt	539	11.5	Jo	Y AND			T PER			546	11.5	Pt	469	11.7	Sl
α CAS			545	11.4	Jo	013338			021258			RR CEP			473	11.3	Bl
003656			545	11.5	Pt	506	9.6	L	506	8.6	Jo	022980			484	10.8	Bl
517	2.6	Mc	554	11.6	Jo	518	9.4	Pt	509	8.9	Ah	471	14.0	Br	495	9.8	Bl
518	2.4	Mc	557	11.6	Fd	534	9.6	Fd	510	8.5	Jo	527	[13.7	Br	U ARI		
519	2.2	Mc	558	11.8	Jo	543	9.9	L	517	8.7	Jo	541	[13.7	Br	030514		
520	2.4	Mc	564	11.5	Pc	545	9.6	Pt	518	8.6	Pt	555	[13.7	Br	541	8.9	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.	J.D.Est.	Obs.
X CET		R RET		T LEP		SU TAU		V AUR		L_2 PUP	
031401		*043263*		*050022*		054319		061647		*071044*	
541	10.8 L	495	12.3 Bl	473	11.0 Bl	545	10.0 L	496	8.8 L	473	4.5 Sl
546	11.4 Pt	505	12.4 Bl	484	11.6 Bl	S COL		545	8.9 L	484	4.1 Sl
553	11.5 L	508	13.2 Sl	S PIC		*054331*		AG AUR		494	4.1 Sl
Y PER		X CAM		*050848*		472	12.2 En	062047		499	4.0 Sl
032043		043274		466	11.4 En	473	12.2 Bl	496	10.2 L	506	4.0 Sl
518	8.1 Pt	504	10.5 L	472	11.4 En	474	12.2 Ht	541	9.8 L	RR MON	
520	9.0 Ah	510	9.4 Me	473	10.8 Bl	478	12.1 Ht	NOV PIC		071201	
535	8.2 Jo	529	7.5 GD	474	10.8 Ht	484	12.0 Bl	*063462*		423	8.4 By
539	8.0 Jo	534	7.6 L	478	11.0 Ht	485	12.2 Ht	466	8.5 En	441	11.4 Kd
546	8.0 Pt	545	8.0 L	484	11.4 Bl	495	11.6 Bl	472	8.5 En	479	9.7 Ch
547	8.7 Ah	546	7.9 Pt	485	11.5 Ht	505	11.6 Bl	478	8.4 Ht	V GEM	
549	8.0 Jo	R DOR		495	11.7 Bl	R COL		482	8.5 En	071713	
559	8.1 Jo	*043562*		505	11.8 Bl	*054629*		485	8.4 Ht	479	10.0 Ch
569	8.9 Mc	466	5.3 En	R AUR		466	[13.0 En	497	8.4 En	480	9.7 Vh
R PER		469	5.5 Sl	050953		473	[13.0 Bl	503	8.3 En	S CMI	
032335		472	5.5 En	546	9.8 Pt	485	[13.0 Ht	511	8.3 En	*072708*	
538	[11.7 Fd	473	5.4 Bl	T PIC		α ORI		S LYN		475	10.4 Ch
541	11.5 L	474	5.2 Ht	*051247*		054907		063558		T CMI	
NOV PER		475	5.3 Sl	466	9.7 En	472	0.1 Sl	479	12.9 Ch	072811	
032443		478	5.2 Ht	472	10.1 En	477	0.1 Sl	496	13.1 L	475	12.0 Ch
546	13.4 Pt	482	5.5 En	473	11.0 Bl	494	0.1 Sl	527	11.2 L	Z PUP	
R TAU		484	5.2 Sl	474	10.9 Ht	U ORI		543	9.9 L	*072820b*	
042209		484	5.4 Bl	478	11.2 Ht	054920a		Y MON		467	[12.6 En
546	9.3 Pt	485	5.5 Ht	484	11.3 Bl	430	10.0 Kd	065111		482	[12.1 En
W TAU		494	5.3 Sl	485	11.4 Ht	441	10.4 Kd	479	[13.3 Ch	497	[12.1 En
042215		495	5.6 Bl	495	11.6 Bl	469	10.8 Sl	R LYN		S VOL	
546	12.1 Pt	499	5.7 Sl	505	12.2 Bl	V CAM		065355		*073173*	
S TAU		505	5.7 Sl	T COL		054974		496	12.5 L	467	12.0 En
042309		505	5.5 Bl	*051533*		543	14.1 L	535	9.8 L	472	12.0 En
546	13.2 Pt	508	5.7 Sl	466	11.5 En	Z AUR		545	9.6 L	473	12.0 Bl
T CAM		518	5.6 Bl	472	11.6 En	055353		Z CMA		478	11.7 Ht
043065		R CAE		473	11.4 Bl	518	10.3 Pt	*065911*		482	12.0 En
504	10.5 L	*043738*		474	11.4 Ht	537	10.3 Mc	469	10.4 Sl	484	11.7 Bl
510	9.7 Jo	473	[12.0 Bl	478	11.4 Ht	540	10.0 Mc	484	10.4 Sl	485	11.6 Ht
514	9.5 Jo	R PIC		484	11.2 Bl	545	11.0 Pt	494	10.3 Sl	495	10.0 Bl
535	9.5 Jo	*044349*		495	11.0 Bl	546	11.0 Pt	508	10.3 Sl	497	10.7 En
535	9.8 L	466	6.8 En	S AUR		547	11.0 Pt	V CMI		503	9.5 En
539	9.3 Jo	472	6.7 En	052034		R OCT		070109		505	9.3 Bl
545	9.3 Jo	473	6.4 Bl	546	8.2 Pt	*055686*		479	[12.7 Ch	511	9.1 En
545	9.9 L	474	6.5 Ht	W AUR		473	11.6 Bl	R GEM		518	8.8 Bl
546	9.8 Pt	478	6.7 Ht	052036		478	11.6 Ht	070122a		U CMI	
559	9.5 Jo	484	6.3 Bl	545	12.9 L	484	12.0 Bl	479	11.4 Ch	073508	
RX TAU		485	7.2 Ht	546	12.5 Pt	486	11.6 Ht	R CMI		475	13.0 Ch
043208		495	6.3 Bl	S CAM		495	11.0 Sl	070310		S GEM	
545	10.5 L	505	7.5 Bl	053068		495	11.3 Bl	479	8.3 Ch	*073723*	
R RET		518	7.9 Bl	512	10.1 Ws	498	11.0 En	R VOL		482	13.7 Ch
043263		R LEP		528	9.4 Ws	505	11.5 Bl	*070772*		W PUP	
466	11.6 En	*045514*		535	9.9 Jo	506	11.0 En	467	11.7 En	*074241*	
469	11.7 Sl	380	7.3 Mn	546	9.2 Pt	506	10.8 Sl	472	11.8 En	467	11.9 En
472	11.7 En	398	7.5 Mn	RR TAU		518	10.7 Bl	478	11.5 Ht	472	12.0 En
473	11.8 Bl	469	6.4 Sl	053326		X AUR		482	12.0 En	473	11.7 Bl
474	11.9 Ht	V ORI		545	10.9 L	060450		485	11.8 Ht	474	11.5 Ht
478	11.8 Ht	050003		RV AUR		482	12.1 Ch	497	12.4 En	478	11.7 Ht
482	12.6 En	553	9.1 L	053337		504	11.5 L	503	12.6 En	482	11.2 En
484	12.0 Bl	T LEP		546	[11.5 Pt	545	8.2 L	511	13.0 En	484	10.9 Bl
485	12.3 Ht	*050022*		U AUR		546	8.7 Pt	L_2 PUP		485	11.2 Ht
495	12.9 Sl	466	11.3 En	053531				*071044*		495	9.4 Bl
		472	11.8 En	545	10.3 L			467	5.0 Sl	497	9.3 En

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
W PUP	V UMA	R CAR	R LEO	RR CAR	W VEL
074241	090151	*092962*	094211	*095458*	*101153*
503 9.7 En	510 9.9 Me	497 8.5 En	499 7.4 Mc	485 8.1 Ht	483 9.0 En
505 8.8 Bl	510 9.8 Sf	503 8.4 En	503 6.5 Be	497 7.9 En	484 8.3 Bl
511 8.2 En	512 10.3 Vh	505 8.2 Bl	503 6.6 An	503 7.9 En	485 9.1 Ht
518 8.2 Bl	523 9.9 Sf	508 7.7 Sl	503 6.7 Oy	511 7.9 En	495 9.2 Bl
T GEM	531 10.9 Mc	511 7.9 En	505 6.6 Wd	RV CAR	497 9.2 En
074323	532 10.0 L	518 7.3 Bl	505 7.5 Mc	*095563*	503 9.6 En
482[13.1 Ch	534 10.1 Sf	X HYA	505 6.6 Jo	467 11.4 En	511 9.6 En
R CNC	537 10.5 Mc	*093014*	506 6.7 Vh	472 11.3 En	518 9.5 Bl
081112	540 10.9 Mc	475 11.6 Ch	506 6.7 Oy	473 11.8 Bl	U HYA
452 6.9 HS	544 10.3 L	Y DRA	506 7.1 HS	478 11.8 Ht	*103212*
475 7.0 Ch	559 8.9 Mc	093178	507 7.5 Mc	482 11.8 En	437 6.0 Kd
V CNC	564 11.0 Mc	532 12.7 L	507 6.7 Jo	484 12.1 Bl	441 6.1 Kd
081617	569 10.7 Mc	544 11.1 L	508 7.5 Mc	485 12.5 Ht	446 5.9 Kd
475 12.6 Ch	U CNC	R LMI	509 7.0 Oy	495 12.6 Bl	452 5.7 Kd
R CHA	090425	093934	509 6.7 Pt	497 12.0 En	466 5.6 Kd
082476	475 13.2 Ch	475 8.4 Ch	510 6.8 Wd	503 12.4 En	468 5.5 Kd
469[12.6 Sl	495 12.1 L	496 7.7 Je	510 6.6 Jo	505 13.0 Bl	475 5.6 Ch
478[12.6 Ht	RX UMA	496 7.0 Ch	514 6.7 Jo	S CAR	496 6.0 Be
484[12.6 Sl	090567	505 7.5 Jo	L CAR	*100661*	RZ CAR
485[12.6 Ht	495 10.4 L	507 7.7 Je	*094262*	467 8.1 En	*103270*
497[12.4 En	519 10.4 L	509 7.3 Pt	440 4.0 Sl	469 8.0 Sl	467 11.3 En
505[12.6 Bl	534 10.4 L	510 7.0 Wd	450 3.4 Sl	472 8.7 En	472 11.0 En
508[12.6 Sl	554 11.0 L	510 7.3 Jo	456 3.4 Sl	473 8.4 Bl	478 10.4 Ht
U CNC	RW CAR	511 7.2 Fd	469 4.0 Sl	474 8.3 Sl	483 10.6 En
083019	*091868*	514 7.2 Wd	474 4.2 Sl	474 8.5 Ht	485 10.6 Ht
475[13.3 Ch	467 9.9 En	514 7.2 Jo	475 4.0 Sl	478 9.3 Ht	497 10.3 En
X UMA	472 9.9 En	517 7.1 Jo	484 3.4 Sl	482 9.5 En	503 10.6 En
083350	473 9.8 Bl	RR HYA	499 3.9 Sl	484 9.2 Bl	511 10.4 En
479 10.3 Vh	478 9.7 Ht	*094023*	506 4.0 Sl	484 8.5 Sl	R UMA
484 10.3 Vh	482 9.8 En	441 12.2 Kd	508 3.9 Sl	485 9.5 Ht	103769
497 9.3 Vh	484 10.0 Bl	446 12.1 Kd	Y HYA	495 8.4 Sl	475 12.8 Ch
503 10.1 Vh	485 9.7 Ht	452 11.5 Kd	*094622*	495 9.1 Bl	496 11.7 Ch
505 9.4 Jo	495 9.9 Bl	466 10.1 Kd	467 7.5 En	497 9.3 En	497 11.6 We
509 9.9 Pt	497 9.9 En	467 10.0 En	472 7.5 En	506 7.8 En	502 11.7 Vh
510 9.5 Jo	503 10.7 En	468 9.7 Kd	482 7.8 En	508 7.4 Sl	505 11.3 Wd
512 9.5 Vh	505 10.9 Bl	472 9.9 En	497 8.0 En	511 7.5 En	506 10.8 Jo
513 9.5 Jo	511 11.4 En	482 8.9 En	503 8.0 En	518 6.7 Bl	509 11.0 Bc
515 9.5 Mg	518 11.0 Bl	497 9.6 En	511 8.0 En	U UMA	509 11.0 Pt
517 9.5 Jo	Y VEL	503 9.9 En	Z VEL	100860	510 11.0 Wd
527 10.0 Jo	*092551*	511 9.9 En	*094953*	475 6.9 Ch	510 10.9 Vh
S HYA	473 13.4 Bl	R LEO	467[12.8 En	502 6.7 Mn	510 10.4 Jo
084803	484 13.4 Bl	094211	473[12.8 Bl	511 6.4 Mn	511 11.1 Fd
475 8.8 Ch	495 13.1 Bl	436 6.7 Kd	478 13.5 Sl	529 6.5 Mn	512 10.9 Wd
T HYA	505 13.0 Bl	446 6.4 Kd	484 13.8 Sl	536 6.6 Mn	512 9.9 Jo
085008	R CAR	452 5.8 HS	497[12.8 En	542 6.5 Mn	514 10.7 Wd
482 12.1 Ch	*092062*	466 6.4 Kd	505[12.8 Bl	Z CAR	517 10.5 Wd
T CNC	467 9.2 En	469 6.6 Kd	V LEO	*101058a*	517 9.6 Jo
085120	472 9.2 En	473 6.8 Kd	095421	467[12.6 En	518 10.0 Ah
475 9.6 Ch	473 8.7 Sl	474 6.3 An	475 13.3 Ch	478[12.3 Ht	520 9.8 Ah
T PYX	473 9.5 Bl	475 6.3 Ch	496 12.9 Ma	485[12.3 Ht	521 10.2 Wd
090031	474 9.4 Ht	481 6.3 Vh	496 12.7 Ch	497[12.6 En	521 8.9 Jo
473 [t Bl	478 9.4 Ht	488 6.4 An	509 12.3 Pt	W VEL	524 8.6 Fd
505 [t Bl	482 8.9 En	488 6.4 Ma	RR CAR	*101153*	524 9.3 Vh
V UMA	484 8.4 Sl	495 6.5 Sz	*095458*	467 8.4 En	525 9.7 Wd
090151	484 9.3 Bl	496 6.8 Ma	467 7.8 En	472 8.3 En	527 8.6 HS
496 9.8 L	485 9.1 Ht	496 6.5 Ch	472 7.5 En	473 8.9 Bl	527 8.7 Jo
505 10.6 Mc	495 8.1 Sl	497 7.0 Oy	474 8.0 Ht	474 8.9 Ht	529 8.7 Mn
508 10.7 Mc	495 8.8 Bl	497 6.9 Vh	478 8.0 Ht	478 9.1 Ht	530 8.4 We

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R UMA	W LEO	W CEN	SS VIR	R VIR	RS UMA
103769	104814	*115058*	*122001*	123307	123459
531 8.4 Mc	495 13.9 L	473 9.0 Bl	517 7.0 Jo	509 10.4 Pt	558 8.7 Jo
534 8.5 Wd	510 13.5 Ch	478 9.1 Ht	527 6.7 Jo	509 10.1 Ah	561 9.2 Ma
534 8.3 Jo	RS CAR	483 9.4 En	532 6.6 L	510 9.8 Ch	565 8.6 Fd
535 8.3 Sz	*110361*	485 9.5 Ht	535 7.5 Sz	510 9.8 Hl	569 8.7 Fd
535 8.1 Mc	469[12.3 Sl	485 9.3 Bl	543 7.1 L	511 10.0 Mn	S UMA
535 8.4 Gy	506[12.3 En	495 10.4 Bl	T CVN	512 9.9 Ws	123961
536 8.6 Mn	S LEO	498 11.0 En	122532	523 9.0 Hl	488 8.9 Ma
537 8.2 Mc	110506	503 11.2 En	506 9.6 Jo	531 8.1 Mc	496 8.8 Ma
538 8.2 Wd	475 12.0 Ch	511 12.2 En	509 10.2 Pt	536 7.5 Pt	501 8.6 Ma
539 8.2 Wd	488 11.7 Ma	518 11.9 Bl	510 9.8 Ch	536 7.6 Ad	501 9.0 Mn
539 8.2 HS	495 11.5 L	R COM	510 10.0 Hi	537 7.5 Mc	502 8.7 Vh
539 8.1 Jo	496 10.2 Ma	115919	510 9.9 Jo	540 7.8 Mc	505 9.2 Wd
540 8.0 Mc	509 10.8 Pt	475 9.6 Ch	511 10.3 Fd		506 8.7 Ah
541 8.2 We	510 10.0 Mp	503 10.4 Vh	513 9.6 Th	RS UMA	506 8.6 Jo
542 8.4 Mn	510 10.1 Ch	506 10.5 Jo	527 10.1 Fd	123459	508 8.8 Bc
542 8.1 HS	RY CAR	510 11.0 Jo	528 10.0 Jo	488 13.3 Ma	509 8.9 Mn
545 8.3 HS	*111561*	510 10.7 Ch	546 9.9 Th	496 12.8 Ma	509 8.6 Ah
545 8.0 Jo	473[13.5 Bl	510 10.5 Vh	Y VIR	501 12.8 Ma	509 8.8 Pt
545 7.9 Wd	485[13.1 Ht	SU VIR	*122803*	509 12.4 Pt	510 8.7 Mc
547 8.2 Ah	498[13.1 En	120012	495 14.2 L	510 12.0 Jo	510 9.2 Wd
549 7.8 Wd	511[13.1 En	475 11.3 Ch	510[12.9 Ch	510 12.6 Ch	510 8.5 Vh
554 8.0 Wd	RS CEN	483 11.4 Ma	534[12.9 L	510 12.4 Bn	510 8.5 Jo
554 7.8 Jo	*111661*	488 11.5 Ma	U CEN	511 12.3 Fd	510 8.5 Ch
554 8.0 Sz	467 10.8 En	495 11.8 Sz	*122854*	513 12.0 Jo	511 8.7 Wr
558 7.6 Jo	472 10.8 En	495 11.8 L	468 10.0 En	514 12.3 Bn	511 8.6 Fd
559 8.2 Mc	473 10.4 Bl	496 11.9 Ma	472 9.9 En	517 12.2 Bn	512 8.6 Ah
560 8.0 We	478 10.3 Ht	509 12.4 Pt	473 9.6 Bl	517 11.8 Jo	513 8.4 Jo
564 8.4 Mc	483 10.0 En	510 12.5 Ch	478 9.6 Ht	517 11.2 Fd	514 9.0 Wd
569 8.4 Mc	484 9.9 Bl	510 12.3 Mp	483 8.6 En	521 11.5 Jo	515 8.5 Ah
569 7.4 Fd	485 9.9 Ht	528 12.6 L	485 8.6 Ht	524 10.9 Fd	517 8.7 Wd
V HYA	495 9.4 Bl	T VIR	485 8.9 Bl	525 11.5 Bn	517 8.4 Fd
104620	498 8.6 En	*120005*	495 8.2 Bl	525 10.4 Wd	517 8.3 Jo
467 7.7 En	503 9.0 En	495 13.8 L	498 8.0 En	527 10.5 Jo	518 8.6 Ah
472 7.6 En	511 9.0 En	R CRV	503 8.0 En	529 11.1 Ch	519 8.5 Ah
473 6.5 Bl	518 8.6 Bl	*121418*	511 7.9 En	529 10.4 Mn	520 8.5 Ah
475 7.8 Ch	X CEN	441 12.2 Kd	518 7.9 Bl	530 11.0 Wr	521 8.3 Ah
481 7.7 Vh	*114441*	446 12.5 Kd	T UMA	531 10.4 Fd	521 8.9 Wd
483 7.6 En	464 12.6 En	468 12.8 Kd	123160	534 10.6 Jo	521 8.4 Jo
495 6.5 L	472 13.1 En	474 12.2 An	377 8.1 Mn	534 9.8 Wd	523 8.4 Ah
495 6.6 Bl	473 12.8 Bl	474 12.8 Sl	452 10.6 HS	535 10.3 Gy	524 8.6 Fd
496 7.6 Ch	474 13.1 Ht	479 12.7 By	488 12.5 Ma	536 10.2 Mn	525 8.8 Wd
497 7.5 En	478 12.7 Ht	485 12.0 Sl	496 12.2 Ma	536 10.3 Pt	527 8.3 Jo
503 7.4 En	483 12.6 En	495 11.5 L	499 12.6 Vh	539 10.5 Bn	529 8.6 Mn
511 7.6 En	484 12.7 Bl	506 10.8 Sl	501 12.5 Ma	539 10.0 Wd	530 8.1 Wr
518 6.6 Bl	495 12.2 Bl	507 10.7 By	508 12.0 Bc	539 9.6 Jo	531 7.8 Fd
RS HYA	498 12.2 En	509 11.0 Pt	509 13.0 Pt	539 10.2 Bc	532 8.1 Ah
104628	503 11.8 En	510 10.5 Jo	510 12.6 Ch	541 10.2 Bf	534 8.6 Wd
468 12.5 En	511 11.2 En	510 10.3 Wd	513 12.6 Vh	542 9.6 Mn	534 8.2 Jo
472 12.6 En	AD CEN	512 10.6 Mn	536 12.8 Pt	545 9.5 Jo	535 8.1 Ah
473 12.5 Bl	*114858*	513 10.3 Jo	561 12.4 Ma	545 9.5 Wd	535 8.4 Gy
483 12.7 En	468 9.1 En	SS VIR	R VIR	546 9.3 Mn	536 8.3 Mn
484 12.6 Bl	478 9.5 Ht	*122001*	123307	549 8.8 Jo	536 8.2 Pt
497 13.0 En	485 9.4 Ht	495 7.3 Sz	488 11.3 Ma	549 9.1 Wd	537 8.4 Bc
506 13.0 En	498 9.1 En	495 7.1 L	495 11.2 Sz	554 9.1 Wd	537 8.7 Mc
511 13.7 En	W CEN	506 7.8 Jo	496 10.5 Mn		539 8.2 Wd
W LEO	*115058*	507 7.2 Sz	496 11.3 Ma		539 8.0 Jo
104814	468 8.3 En	510 7.3 Jo	507 10.5 Mc		539 8.3 Bc
475[13.4 Ch	472 8.3 En	515 6.6 L	507 10.0 Sz		

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
S UMA			**U OCT**			**S VIR**			**T CEN**			**T APS**			**U UMI**		
123961			*131283*			*132706*			*133633*			*134677*			141567		
539	8.3	Bf	486	9.7	Ht	473	10.0	En	468	8.0	En	468	9.3	En	512	8.4	Ah
540	8.5	Mc	486	10.0	En	478	9.8	Sl	473	7.8	En	473	9.0	En	517	7.9	Jo
541	8.2	Bf	495	10.2	Bl	478	10.0	Ht	474	6.8	Bl	474	9.0	Bl	518	8.6	Ah
542	7.9	Mn	498	10.2	En	481	9.8	Ch	475	7.1	Kd	478	9.2	Ht	519	8.6	Hi
545	7.7	Jo	503	10.5	En	483	9,4	En	478	6.9	Ht	485	9.0	Bl	520	8.8	Ah
545	8.0	Wd	511	10.5	En	484	9.3	Mn	478	6.7	Sl	486	9.7	Ht	523	8.9	Ah
546	7.6	Ah	518	11.0	Bl	485	9.1	Sl	485	6.4	Sl	486	9.4	En	527	8.6	Jo
547	7.6	Ah	**V CVN**			485	9.8	Ht	485	6.5	Ht	495	9.7	Bl	531	9.0	Hi
549	7.9	Wd	131546			496	8.6	Sl	485	6.7	Bl	498	9.5	En	534	8.7	Jo
549	7.8	Jo	508	7.4	GD	498	9.2	Mn	486	6.4	Kd	503	9.7	En	536	9.0	Pt
551	7.6	Ah	523	7.4	GD	498	9.3	En	495	6.2	Bl	511	10.6	En	538	9.4	Fd
554	8.0	Wd	528	7.8	GD	503	9.0	En	496	6.1	Sl	**RR VIR**			547	9.7	Ah
557	7.3	Fd	529	7.5	GD	506	8.2	Sl	498	6.0	En	*135908*			549	8.8	Jo
558	7.9	Jo	533	7.5	GD	506	8.7	HS	499	6.0	Sl	510[	12.8	Mp	554	9.5	Jo
559	8.3	Mc	536	7.7	GD	507	8.5	Jo	503	5.9	Sl	528[	12.8	Mp	559	9.7	Jo
562	7.8	Ma	557	7.5	GD	509	8.2	Pt	503	6.0	En	**Z BOO**			**S BOO**		
564	8.2	Mc	559	8.1	GD	510	8.0	Jo	508	5.9	Sl	140113			141954		
565	8.2	Fd	563	8.1	GD	511	8.0	En	511	6.0	En	471	9.9	Br	471	11.7	Br
569	7.4	Fd	**W VIR**			512	8.0	Jo	**RT CEN**			488	10.2	Ma	479	11.4	Ch
569	8.7	Mc	*132002*			512	8.0	Mn	*134236*			498	11.5	L	501	10.6	L
RU VIR			524	9.5	Sd	524	7.6	Mg	441	10.3	Kd	501	11.0	Ma	506	10.4	Jo
124204			524	9.3	Mg	524	7.4	Sd	446	10.0	Kd	509	11.5	Ma	509	10.2	Pt
498	10.9	L	**V VIR**			526	7.4	Ch	452	9.7	Kd	528	13.0	L	510	10.2	Jo
509	10.8	Pt	*132202*			527	7.4	HS	466	9.4	Kd	561[	12.6	Ma	511	10.1	Th
519	11.3	L	471	9.5	Br	530	6.9	Za	468	9.1	Kd	**Z VIR**			512	10.1	Ws
524	11.8	Mg	506	9.5	Jo	531	7.1	Za	468	9.5	En	*140512*			514	10.0	Th
524	11.7	Sd	511	9.6	Jo	532	7.1	Za	473	9.5	En	496[	12.7	By	514	10.0	Jo
526	11.9	Mg	524	10.0	Sd	534	7.4	HS	474	9.2	Bl	496	14.5	L	517	9.7	Jo
534	11.6	L	524	10.1	Mg	535	7.2	Sz	475	9.3	Kd	528[	14.3	L	519	9.5	L
536	11.4	Pt	528	10.6	L	536	7.1	Pt	478	9.5	Ht	**RU HYA**			523	9.0	Ws
553	12.1	Be	**R HYA**			539	7.8	HS	485	9.4	Ht	*140528*			526	9.0	Bg
553	12.1	L	*132422*			542	7.7	HS	485	9.3	Bl	474	13.2	Bl	527	8.9	Jo
U VIR			441	6.9	Kd	**RV CEN**			495	9.3	Bl	485	13.3	Ht	527	8.9	Ws
124606			446	7.0	Kd	*133155*			498	9.2	En	485	13.5	Bl	528	8.8	GD
479	10.1	By	468	7.5	En	468	10.2	En	503	9.0	En	503	13.0	En	534	8.6	Fd
495	10.1	L	473	7.5	En	473	10.1	En	511	9.3	En	511	12.8	En	534	8.5	Jo
507	9.5	By	474	7.8	Bl	474	9.6	Bl	**R CVN**			**R CEN**			534	8.5	L
514	9.4	Hi	478	7.8	Ht	478	10.2	Ht	134440			*140959*			535	8.4	Gy
519	8.7	L	478	7.3	Sl	483	10.1	En	441	7.8	Kd	468	6.0	En	536	8.2	Pt
524	8.5	Mg	481	7.7	Ch	485	10.1	Bl	446	7.9	Kd	473	6.2	En	539	8.2	Jo
524	8.3	Sd	483	7.5	En	485	10.2	Ht	469	9.0	Kd	474	6.7	Bl	541	8.1	We
534	7.9	L	485	7.9	Bl	495	10.2	Bl	509	10.0	Pt	475	6.5	Pt	545	8.1	Jo
536	7.8	Pt	485	7.8	Ht	498	10.0	En	512	10.3	Ah	478	6.5	Ht	545	8.3	Th
537	8.0	Hi	485	7.4	Sl	503	10.2	En	512	10.3	Ws	485	6.8	Ht	547	7.9	Th
553	7.9	Be	495	7.7	L	511	10.0	En	524	10.5	Mg	485	6.7	Sl	548	8.0	Th
553	7.9	L	495	7.6	Sl	518	9.7	Bl	524	10.3	Sd	485	7.0	Bl	549	8.0	Jo
RV VIR			495	7.5	Bl	**T CMI**			528	10.4	Ws	486	6.7	En	552	8.5	Be
130212			498	8.0	En	133273			534	10.5	Jo	496	7.1	Bl	552	8.2	L
495	11.7	L	503	8.5	En	471	9.8	Br	535	10.5	Gy	498	7.0	En	553	8.5	Bg
519	11.9	L	506	7.7	Sl	501	11.1	L	536	11.5	Pt	499	6.7	Sl	554	8.0	Jo
534	12.1	L	509	8.5	Pt	519	12.1	L	539	10.7	Jo	503	7.3	En	559	8.2	GD
U OCT			511	8.7	En	**T CEN**			**RX CEN**			508	6.8	Sl	558	8.3	Jo
131283			518	8.8	Bl	*133633*			*134536*			511	7.0	En	562	8.5	Bg
468	9.3	En	526	9.5	Ch	441	7.0	Kd	468[	13.1	En	**U UMI**			**RS VIR**		
473	9.3	En	534	8.4	L	446	7.2	Kd	474[	13.1	Bl	141567			142205		
473	9.0	Bl	**S VIR**			452	7.7	Kd	485[	13.1	Ht	506	8.4	Ah	471	13.6	Br
478	9.8	Ht	*132706*			466	7.6	Kd	498[	13.1	En	509	8.2	Pt	495	13.8	L
485	10.0	Bl	468	10.2	En	468	7.5	Kd	511[	13.1	En	509	8.4	Hi	528	14.3	L

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V Boo	R CAM	RT LIB	RS LIB	S UMi	R CrB
142539a	142584	*150018*	*151822*	153378	154428
441 10.0 Kd	506 8.9 Ah	516[12.4 Mg	498 8.3 En	538 8.5 Fd	503 6.0 Be
446 10.0 Kd	511 9.0 Th	535 13.1 Mg	498 8.3 L	539 8.4 Ko	503 5.9 Oy
466 7.9 Kd	514 9.0 Th	T LIB	504 8.8 En	539 8.2 Jo	503 6.0 L
469 8.0 Kd	514 9.0 Hi	*150519*	513 9.4 En	541 8.6 Ko	504 5.9 An
475 8.2 Kd	520 9.2 Ah	528 14.4 L	522 9.5 L	545 8.4 Ko	504 6.0 L
479 8.0 Ch	527 9.6 Br	544 13.4 L	534 10.6 L	545 8.0 Jo	505 6.1 Wd
480 7.9 Vh	529 9.7 GD	Y LIB	553 11.0 L	547 8.4 Ah	505 6.0 Jo
484 7.6 Vh	544 10.3 Br	*150605*	RU LIB	548 8.4 Ko	506 6.2 HS
506 7.8 Ah	545 10.7 Th	496 13.7 L	*152714*	554 8.1 Jo	506 6.1 Oy
506 7.5 Jo	547 10.7 Ah	528 13.6 L	478 12.8 Ch	557 8.5 Sf	506 6.1 Ah
509 7.8 Pt	547 10.0 Bg	531[12.0 Za	496 13.6 L	558 8.1 Jo	506 5.9 L
510 7.6 Jo	555 10.6 Br	532[12.0 Za	498 13.1 Ch	569 8.6 Sf	506 6.1 Pt
511 7.4 Fd	R Boo	544 13.4 L	528[13.6 L	U LIB	507 6.0 Be
513 7.2 Fd	143227	S LIB	R NOR	*153620a*	507 6.0 Je
514 7.5 Jo	479 9.7 Ch	*151520*	*152849*	485 13.0 Bl	507 6.1 Mc
515 7.9 Ah	509 11.8 Pt	478 8.6 Ch	468 10.9 En	T NOR	508 6.1 Pt
517 7.2 Fd	834 11.0 HS	498 8.4 L	473 10.8 En	*153654*	508 6.0 GD
517 7.7 Jo	536 12.3 Pt	498 8.5 Ch	474 10.8 Bl	468 10.6 En	509 6.0 Oy
518 8.0 Ah	538 11.5 Fd	512 8.7 Vh	478 11.5 Ht	473 10.8 En	509 6.1 Pt
519 7.9 Ah	V LIB	522 9.1 L	485 11.3 Bl	478 11.4 Ht	510 6.0 Be
520 8.0 Ah	*143417*	524 8.9 Vh	485 11.5 Ht	485 11.9 Ht	510 6.2 Wd
523 8.1 Ah	495 11.7 L	534 9.4 L	496 11.4 Bl	498 11.9 En	510 6.0 Jo
524 7.3 Fd	528 13.7 L	536 9.0 Pt	498 11.2 En	504 12.6 En	511 6.1 Pt
527 7.3 Fd	S LUP	553 10.4 Be	504 11.2 En	513 12.8 En	511 6.2 Ch
527 7.7 Jo	*144646a*	553 9.9 L	513 11.5 En	Z LIB	512 6.5 Je
528 7.6 GD	468 12.1 En	S SER	X LIB	*154020*	512 6.1 Mg
529 7.7 Fd	473 12.3 En	151714	*153020*	485 12.9 Bl	512 6.0 Jo
531 7.7 Fd	478 12.6 Sl	478 13.5 Ch	485 11.0 Bl	R CrB	512 6.1 Pt
531 7.6 Mc	499[12.1 En	488 13.1 Ma	496 10.9 Bl	154428	513 6.0 Be
534 8.4 Jo	506[12.1 Sl	501 12.7 Ma	W LIB	434 6.3 Kd	513 6.1 Mg
534 8.6 Sf	513[12.1 En	502 12.8 L	*153215*	440 6.2 Kd	513 6.2 Pt
535 8.2 Mc	U Boo	514 10.5 Th	478 13.1 Ch	446 6.2 Kd	514 6.0 Lg
535 8.3 Ah	144918	516 12.7 Mg	485 13.5 Bl	452 6.2 Kd	514 6.1 Wd
536 8.0 Pt	479 11.3 Ch	522 11.4 L	498 12.9 Ch	453 6.3 HS	514 6.1 Mg
537 8.4 Mc	510 11.2 Mp	527 12.5 Fd	528 11.3 L	466 6.1 Kd	515 6.0 Mg
538 8.2 Fd	528 10.5 Mp	534 12.1 L	544 11.6 L	468 6.1 Kd	515 6.1 Ah
539 7.9 Jo	539 10.4 Mp	552 12.0 L	S UMi	474 5.9 An	515 6.0 L
539 8.5 Sf	Y LUP	561 12.0 Ma	153378	475 6.2 Kd	516 6.0 Be
540 8.2 Mc	*145254*	565 12.5 Bg	478 9.2 Ch	478 6.2 Ch	516 6.0 Mg
540 8.5 Ah	468[13.7 En	S CrB	480 9.3 Vh	482 6.2 Ch	517 6.0 Mg
545 7.8 Jo	474[13.7 Bl	151731	500 8.8 Ch	486 6.2 Kd	517 6.0 Jo
546 8.5 Ah	499[13.7 En	441 12.2 Kd	509 9.1 Ah	488 6.1 An	517 5.9 Fd
547 8.5 Ah	S APS	478 12.5 Ch	510 9.3 Sf	494 6.0 Je	518 6.1 Ah
549 7.8 Jo	*145971*	497 12.5 Ch	510 8.8 Jo	495 6.0 L	518 6.1 Pt
551 8.5 Ah	468 10.1 En	508 12.0 Bc	511 9.1 Pt	495 6.0 Sz	519 6.2 Pt
554 7.9 Jo	473 10.1 En	511 12.2 Pt	512 9.0 Ah	496 6.0 L	519 6.0 L
557 7.9 Fd	474 10.2 Bl	536 11.5 Pt	514 8.7 Jo	496 6.0 Je	520 6.2 Ah
558 8.0 Jo	478 10.0 Sl	558 11.5 Fd	518 8.8 Ah	496 6.0 Be	520 6.1 Pt
559 8.4 Mc	478 10.0 Ht	566 11.1 Pc	520 8.9 Ah	498 6.0 L	521 6.2 Pt
564 8.5 Mc	485 10.2 Bl	RS LIB	522 8.7 Ko	498 6.2 Ch	521 6.0 Jo
565 8.3 Fd	485 10.0 Sl	*151822*	523 8.7 Ko	500 6.0 Be	521 6.1 Wd
566 8.4 Pc	486 10.0 Ht	468 7.7 En	527 8.8 Sf	500 6.0 Mg	522 5.9 L
569 8.8 Sf	496 10.1 Sl	473 7.8 En	530 8.4 Ko	500 6.0 L	522 6.1 Pt
569 8.7 Mc	496 10.2 Bl	474 8.1 Bl	534 8.4 Jo	501 6.0 Mg	523 6.1 Ah
R CAM	498 10.2 En	478 8.1 Ht	534 8.7 Sf	501 6.1 An	523 6.0 Mg
142584	503 10.3 En	485 8.2 Ht	535 8.5 Gy	501 6.0 L	523 6.1 Ko
471 8.0 Br	506 10.4 Sl	485 8.1 Bl	536 8.0 Pt	502 6.1 An	524 6.2 Sd
500 8.1 Ch	511 10.5 En	496 8.2 Bl	537 8.6 Ko	502 5.9 L	524 6.0 Be

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R CrB	R CrB	X CrB	RR Lib	U Ser	RU Her
154428	154428	154536	*155018*	160210	160625
524 6.1 Mg	543 6.0 L	519 11.6 Hi	496 14.2 L	566 11.0 Pc	529 9.5 Fd
524 6.1 Pt	543 6.0 Je	522 12.2 L	501 13.6 Ma	X Sco	534 10.1 HS
525 6.1 Wd	544 5.9 Ko	528 11.3 Hi	532 11.7 L	*160221a*	535 10.0 L
526 6.0 Me	544 5.9 L	536 11.3 Pt	544 10.9 L	485 12.5 Be	536 10.4 Pt
526 6.1 Pt	544 6.0 Oy	537 11.0 Hi	569 9.3 Ma	496 11.5 Be	537 10.4 Ko
527 6.5 HS	545 6.0 L	537 11.3 L	Z CrB	500 11.8 L	539 10.3 HS
527 6.1 Mg	545 5.8 Ko	540 10.9 Hi	155229	527 11.8 L	542 10.4 HS
527 6.1 Pt	545 6.1 Pt	552 10.0 Hi	479 9.9 Ch	544 12.0 L	545 10.2 L
527 6.1 Ch	545 6.0 Jo	552 10.3 L	497 11.2 Ch	SX Her	557 10.3 Fd
527 6.1 L	545 6.2 Wd	561 9.4 Ma	501 11.5 L	160325	566 10.9 Pc
527 6.0 Jo	545 5.8 HS	569 9.4 Ma	522 12.4 L	500 7.9 L	569 10.8 Ma
528 6.1 L	546 6.0 Ah	R Ser	523 12.3 Md	506 8.0 Pt	R Sco
528 6.0 GD	546 6.2 Pt	154615	535 11.2 Md	509 8.0 Pt	*161122a*
528 6.0 Mg	547 6.1 Ah	475 11.9 Ch	537 13.1 L	511 8.0 Pt	478[12.6 Ht
529 6.0 Mg	547 6.1 Pt	497 12.6 Ch	RZ Sco	512 8.0 Pt	485[13.4 Bl
529 6.1 Pt	547 5.9 Ko	511 13.2 Pt	*155823*	513 8.1 Pt	504[12.6 En
530 5.9 Ko	548 5.8 Ko	V CrB	468 9.3 En	518 8.0 Pt	511 12.6 Pt
530 6.0 Be	549 6.2 Ad	154639	473 9.9 En	519 8.0 Pt	513[12.6 En
531 6.0 Je	549 6.4 Si	478 11.2 Ch	478 9.9 Ht	522 7.9 L	524 11.9 Vh
531 5.9 Mc	549 5.9 L	497 10.3 Ch	485 10.4 Ht	529 8.0 Pt	537 10.6 Pt
531 6.1 Pt	549 6.0 Jo	511 10.3 Th	499 11.2 En	530 7.8 Ko	543 11.0 Bg
532 6.1 Pt	550 6.1 Pt	511 9.0 Pt	504 11.5 En	531 8.0 Pt	553 10.6 Bg
532 5.8 We	550 6.5 Si	514 9.8 Th	511 12.1 Pt	532 8.1 Pt	S Sco
532 6.0 L	550 6.0 Be	516 9.4 Mg	513 12.2 En	533 8.0 Pt	*161122b*
533 6.0 GD	550 6.0 Oy	523 9.1 Md	529 12.2 Mp	534 8.0 Pt	478 12.8 Ht
533 6.1 Pt	551 6.0 Ko	526 8.5 Me	536 12.5 Pt	535 7.8 L	485 12.8 Bl
533 5.7 Ko	551 6.5 Si	529 9.7 Bg	539 12.2 Mp	536 8.1 Pt	486 12.4 Ht
534 6.3 HS	551 6.2 Ah	529 8.5 Mp	Z Sco	537 8.1 Pt	511 11.4 Pt
534 6.0 Wd	552 6.0 Be	530 9.8 Md	*160021*	537 7.9 Ko	524 12.0 Vh
534 6.1 Mg	553 6.0 L	536 8.0 Pt	473 11.3 En	538 8.1 Pt	537 12.4 Pt
534 6.1 Pt	554 6.1 Sz	538 8.0 Md	478 11.2 Ht	541 7.7 Ko	W CrB
534 6.0 Jo	554 6.0 Jo	539 7.7 Mp	485 11.0 Bl	545 8.1 L	161138
534 6.0 L	554 6.0 Be	540 8.7 Hi	486 11.0 Ht	545 8.2 Pt	510 11.1 Bc
535 5.9 L	554 6.0 L	545 7.8 Md	496 10.5 L	546 8.2 Pt	511 10.3 Pt
535 6.1 Sz	554 6.1 Wd	545 8.1 Th	496 10.4 Bl	547 8.2 Pt	517 9.4 Fd
535 6.0 Ah	555 6.1 Pt	547 8.1 Th	499 10.3 En	548 8.0 Jo	523 9.0 Md
535 6.0 Ko	557 6.1 Pt	547 7.9 Ah	501 10.2 An	550 8.2 Pt	530 9.5 Md
535 6.0 Gy	557 6.0 GD	548 8.2 Th	501 10.0 Bc	557 8.0 Pt	534 8.8 Fd
535 6.0 Mg	558 6.0 Jo	553 7.7 Md	504 10.3 En	558 8.2 Pt	534 10.6 Jo
535 6.2 Pt	558 6.2 Pt	553 7.6 Bg	509 10.0 Be	559 8.2 Pt	535 10.0 Jo
536 6.2 Pt	559 6.1 Pt	556 7.7 Md	509 10.1 An	560 8.0 Pt	535 10.2 Md
536 6.0 GD	559 6.0 GD	565 8.2 Bg	513 10.3 En	561 8.2 Pt	537 9.1 Pt
537 6.0 Mc	559 5.9 Mc	569 8.5 Mc	522 10.2 L	W Sco	538 9.6 Md
537 6.2 Pt	559 6.1 Fd	R Lib	530 10.0 Mp	*160510*	539 9.8 Jo
537 5.8 Ko	560 6.2 Pt	*154715*	535 10.3 L	485[13.8 Bl	546 9.5 Md
537 5.9 L	561 6.2 Pt	479[12.6 Ch	540 10.2 Mp	RU Her	566 10.8 Pc
538 6.0 L	563 6.0 GD	498[13.0 Ch	540 10.0 Be	160625	569 9.7 Fd
538 6.0 Je	564 6.0 Mc	532[13.9 L	553 9.8 Be	479 8.2 Ch	W Oph
538 6.1 Pt	564 6.0 Ad	R Lup	553 9.8 L	496 8.8 Ma	*161607*
538 5.8 Ko	566 6.1 Pc	*154736*	R Her	496 8.9 Ch	483 11.6 Vh
538 6.1 Wd	569 5.9 Mc	468 9.8 En	160118	500 9.4 L	496 12.0 OL
539 6.0 Be	X CrB	473 10.0 En	517[12.0 Fd	501 8.8 Ma	498 11.8 Vh
539 6.2 HS	154536	485 10.5 Sl	557[12.0 Fd	506 9.4 Ah	507 12.1 Vh
539 6.0 L	488 12.7 Ma	496 11.2 Sl	U Ser	506 9.1 HS	511 12.3 Pt
540 5.8 Mc	493 12.7 Ch	499 11.0 En	160210	517 9.7 Fd	527 12.5 L
541 5.8 We	500 12.8 L	504 11.6 En	511 13.5 Pt	522 9.1 L	545 13.2 L
541 5.8 Ko	501 12.4 Ma	506 11.6 Sl	536 13.3 Pt	527 10.2 HS	
542 6.0 HS	511 12.3 Pt	513 12.2 En	557 11.1 Fd	529 10.4 Me	

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
V OPH	T OPH	R DRA	RS SCO	R OPH	RS HER
162112	*162815*	163266	*164844*	*170215*	171723
481 10.5 Ch	545 11.6 L	525 8.1 Mn	478 6.6 Ht	496 10.6 L	512 8.9 Bw
496 9.0 L	S OPH	527 7.8 Jo	486 6.5 Ht	497 10.7 Vh	513 8.4 Jo
511 8.5 Pt	*162816*	532 7.9 Mn	486 6.5 En	507 10.4 Jo	514 8.9 Ah
513 9.2 Th	482 13.2 Ch	534 7.8 Jo	496 7.0 Bl	510 11.8 Hl	517 8.7 Mg
522 8.2 L	496 14.5 L	534 7.9 Wd	499 6.9 En	511 12.0 Be	517 8.6 Jo
532 9.0 Za	527 14.4 L	535 8.0 HS	504 7.2 En	511 11.7 Fd	520 9.0 Ah
535 7.8 L	553 12.0 L	535 7.6 Gy	513 7.7 En	511 10.6 Jo	523 9.3 Ah
537 8.0 Pt	W HER	537 7.7 Mn	RR SCO	511 11.7 Pt	523 8.9 Md
545 7.9 L	163137	537 7.8 Pt	*165030a*	513 10.3 Mn	530 9.4 Md
U HER	479 12.8 Ch	539 7.5 Jo	473 6.5 En	513 11.4 Fd	534 9.2 Jo
162119	497 11.2 Ch	539 7.5 Wd	478 6.3 Sl	521 10.1 Wd	535 8.0 Md
479 11.4 Ch	501 11.6 Ma	541 7.7 Mn	478 6.9 Ht	527 12.0 L	537 9.1 Pt
496 11.8 Ch	509 11.3 Ma	542 8.2 HS	485 6.8 Sl	528 11.5 Ws	539 9.2 Jo
511 11.9 Fd	511 11.4 Pt	545 7.6 Jo	486 7.2 Ht	528 12.4 Ch	539 9.8 Md
511 11.8 Pt	514 10.3 Th	547 7.8 Ah	486 6.9 En	536 10.5 Mn	545 9.5 Jo
514 12.5 Wd	517 11.2 Fd	548 7.4 Wd	496 7.6 Bl	537 12.7 Pt	546 9.7 Md
517 12.2 Fd	527 10.7 Jo	551 7.8 Ah	498 7.4 Sl	541 10.6 Mn	547 9.8 Hi
527 11.3 Fd	529 11.0 Fd	554 7.7 Jo	499 8.0 En	544 12.4 L	558 9.6 Jo
537 12.5 Pt	534 10.3 Fd	554 7.6 Wd	504 8.4 En	569[12.0 Fd	S OCT
566 12.2 Pc	537 9.9 Pt	559 7.6 Jo	506 7.8 Sl	RT HER	*172486*
Y SCO	538 10.1 Fd	559 7.9 Fd	513 8.8 En	170627	473 8.4 En
162319	545 9.5 Th	564 8.1 Fd	SS OPH	479[12.9 Ch	478 8.0 Ht
535[11.8 Mg	558 8.9 Fd	569 7.7 Fd	*165202*	517[13.4 Mg	486 7.8 Ht
SS HER	569 8.5 Fd	RR OPH	482 9.2 Ch	RW SCO	496 7.0 Bl
162807	569 8.5 Ma	*164319*	498 8.8 Ch	*170833*	506 8.1 En
481 12.5 Ch	R UMI	473 11.6 En	511 8.7 Pt	496[12.5 Bl	513 8.1 En
497 10.1 Ch	163172	487 9.8 En	523 9.4 Md	504[12.5 En	RU OPH
500 10.2 L	513 9.6 Vh	499 9.3 En	530 10.4 Md	a HER	172809
510 8.8 Jo	527 9.1 L	501 9.8 L	534 9.0 Md	171114	482 10.9 Ch
510 8.7 Bc	535 9.3 Jo	504 9.3 En	537 11.7 Pt	535 3.5 Ko	498 9.6 Ch
510 8.8 Sf	539 9.2 Jo	511 9.6 Pt	538 11.3 Md	537 3.3 Ko	500 9.4 L
511 8.8 Pt	540 9.3 Mc	513 9.3 En	545 12.0 Md	538 3.5 Ko	501 9.2 Ma
513 8.7 Th	545 9.3 Jo	519 9.7 L	RV HER	539 3.4 Ko	509 10.1 Ma
517 9.0 Sf	545 9.1 L	533 9.9 Ko	165631	541 3.5 Ko	511 9.7 Pt
517 8.8 Jo	554 9.3 Jo	535 9.9 L	479 10.2 Ch	542 3.3 Oy	517 10.6 Mg
519 8.8 L	558 9.2 Jo	537 10.1 Ko	497 11.2 Ch	544 3.4 Ko	519 10.4 L
521 8.7 Jo	R DRA	537 10.0 Pt	498 11.4 Be	545 3.5 Ko	523 10.5 Md
523 8.9 Sf	163266	545 10.2 L	500 11.3 L	547 3.3 Ko	529 11.4 Fd
527 8.6 Jo	479 11.3 Ch	546 10.1 Th	501 11.4 Be	548 3.5 Ko	530 11.8 Md
534 9.5 Sf	498 10.0 Mn	S HER	501 11.4 An	550 3.5 Oy	535 12.1 L
534 9.8 Fd	498 10.4 Ch	164715	509 12.1 An	551 3.4 Ko	535 11.6 Gy
535 9.6 Jo	501 10.7 Ma	479 7.0 Ch	509 12.1 Be	552 3.4 Ko	537 12.0 Pt
535 9.3 L	505 10.1 Wd	497 7.5 Ch	511 12.2 Pt	554 3.4 Ko	539 12.0 Md
537 9.7 Pt	506 9.6 Ah	506 7.9 Ah	512 12.5 Bw	Z OPH	545 12.3 L
539 9.7 Jo	509 9.3 Ma	511 7.8 Pt	516 12.7 Mg	171401	546 12.4 Md
539 9.8 Sf	510 9.4 Wd	512 7.0 Ws	522 13.0 L	509 11.0 Ah	558[11.6 Fd
541 10.0 Bc	511 9.5 Mn	515 8.0 Ah	534 11.9 Md	511 10.4 Pt	RT SER
545 10.1 Sf	511 9.6 Pt	517 8.5 Fd	537 13.6 Pt	514 9.8 Th	*173411*
545 10.1 L	512 9.3 Ah	518 8.0 Ah	538 14.3 L	520 9.9 Ah	498 12.6 L
546 10.3 Th	514 9.0 Ah	520 8.0 Ah	RT SCO	537 9.0 Pt	527 12.6 L
554 11.2 Sf	514 9.3 Wd	523 8.3 Ah	*165636*	546 9.1 Th	RU SCO
T OPH	514 8.5 Jo	527 8.7 Ws	496[13.0 Bl	547 9.0 Ah	*173543*
162815	517 8.5 Fd	537 9.7 Pt	R OPH	569 8.4 Fd	496 11.7 Bl
496 10.9 L	518 8.9 Ah	547 9.3 Ah	*170215*	RS HER	499 12.4 En
482 10.7 Ch	520 8.7 Ah	558 10.3 Fd	479 10.2 Vh	171723	504 12.6 En
496 10.2 Bl	521 8.0 Jo	RS SCO	482 9.9 Ch	505 8.1 Jo	515 11.8 En
498 10.8 Ch	521 8.2 Wd	*164844*	486 10.3 Vh	510 8.2 Jo	
527 11.8 L	523 8.4 Ah	473 6.6 En	496 10.9 Ch	511 8.4 Pt	

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
SV Sco	V DRA	T HER	W LYR	T SER	X OPH
174135	175654	180531	181136	182306	183308
496 10.3 Bl	496 14.7 L	539 8.9 Jo	517 9.4 Sf	540 10.0 Mp	550 7.5 Oy
499 10.8 En	531 13.2 Mp	542 9.4 HS	517 9.3 Jo	545 9.6 Jo	555 7.4 Jo
504 10.7 En	538 12.9 L	544 9.5 Br	519 9.6 L	555 9.6 Jo	558 7.7 Jo
515 10.0 En	540 12.5 Mp	545 9.4 L	519 9.6 Ah	558 9.7 Jo	564 7.5 Ad
W PAV	R PAV	545 9.5 Jo	520 9.4 Ah	SV DRA	569 7.8 Fd
174162	*180363*	547 9.6 Ah	523 9.2 Sf	183149	RS DRA
478 13.0 Ht	478[12.3 Ht	555 10.3 Jo	523 9.4 Jo	503 13.9 L	184074
484 12.1 En	504[11.9 En	558 10.6 Jo	527 9.0 Jo	504 14.5 Ma	528 9.5 Ch
486 11.3 Ht	T HER	558 11.1 Fd	534 8.9 Sf	538 12.5 L	RY LYR
496 10.0 Bl	180531	560 11.6 Bg	535 8.4 Jo	544 12.1 Br	184134
497 10.1 Sl	475 9.1 Kd	W DRA	536 8.5 GD	RZ HER	497 12.3 L
499 10.4 En	479 9.3 Vh	180565	537 8.6 Pt	183225	511 12.7 Pt
504 10.3 En	481 9.4 Vh	482 13.0 Ch	538 8.7 L	497 12.5 L	528[13.2 Ch
515 9.9 En	481 8.8 Ch	496 14.3 L	539 8.8 Sf	523 13.0 Mg	535 13.4 Lg
RS OPH	484 8.7 Vh	538 14.3 L	539 8.0 Wd	535 13.5 L	535 13.1 L
174406	486 8.6 Kd	561 14.2 Br	539 8.3 Jo	544 13.6 Br	541 13.7 Br
511 11.1 Pt	487 8.2 Vh	X DRA	544 8.7 Ah	545 14.0 L	545 14.1 L
537 11.0 Pt	497 8.2 Vh	180666	545 7.8 Jo	X OPH	R SCT
U ARA	497 7.4 Ch	482 12.8 Ch	545 8.6 Sf	183308	*184205*
174551	500 7.6 L	496 13.8 L	545 8.2 L	500 6.8 L	434 5.9 Kd
478[13.0 Ht	501 7.5 Be	527[14.1 Br	547 8.5 Bg	503 7.3 Mn	483 5.5 Ma
486[13.0 Ht	501 7.6 An	538[14.0 L	547 8.7 Ah	505 6.7 Jo	485 5.5 Sl
RT OPH	502 7.6 Vh	TV HER	548 8.3 Wd	505 6.7 Ad	486 5.5 Kd
175111	506 7.7 Ah	181031	554 7.8 Sf	509 6.6 Ad	488 5.8 Ma
482 10.0 Ch	506 7.3 Jo	497 14.1 L	558 7.8 Jo	510 6.5 Jo	496 5.7 Be
498 10.3 Ch	506 7.8 Bc	538[14.5 L	563 7.5 GD	511 6.5 Ch	496 5.4 Ma
T DRA	507 7.8 Vh	RY OPH	RV SGR	511 7.4 Pt	497 5.4 L
175458a	509 7.6 Me	181103	*182133*	513 7.5 Mn	498 5.4 Vh
481 12.4 Ch	509 7.8 Bc	485 12.4 Sl	496 8.4 Bl	513 6.7 Jo	500 5.8 Ch
482 12.5 Ch	509 7.5 Be	500 11.3 Sl	499 10.0 En	515 6.7 Ad	500 5.7 Sl
510 11.0 Ch	509 7.6 An	506 10.4 Sl	504 10.0 En	517 6.8 Jo	501 6.0 Ma
533 11.0 Md	509 7.8 Ah	511 9.8 Pt	515 10.4 En	518 7.0 Ad	503 5.6 Vh
539 12.4 Sj	510 7.3 Jo	525 9.0 Md	SV HER	519 7.0 L	504 5.8 Be
541 10.9 Md	511 7.8 Bc	529 8.5 Fd	182224	523 7.3 Ad	504 6.0 Ma
560[11.5 Fd	511 7.6 Fd	531 8.0 Md	497 12.3 L	523 6.7 Jo	505 5.7 Wd
UY DRA	511 7.6 Pt	535 8.0 Md	511 10.8 Pt	523 7.1 Ko	505 5.4 Mc
175458b	512 7.5 Vh	537 7.8 Pt	512 11.0 Bw	527 6.6 Jo	506 5.9 Bc
481 11.0 Ch	514 7.6 Ah	541 7.9 Br	519 9.8 L	527 7.4 Ad	506 5.4 Jo
482 11.0 Ch	517 8.1 Bc	542 8.2 HS	528 9.6 Ch	529 7.2 Je	506 5.9 Pt
510 12.5 Ch	517 7.2 Jo	545 8.0 HS	535 9.6 L	530 7.5 Ad	506 5.5 Sl
538 11.0 Fd	519 7.8 Ah	546 8.0 Md	537 9.8 Pt	530 7.3 Ko	507 5.8 Bg
539 12.5 Sj	519 7.5 L	547 7.8 Ah	541 9.7 Br	531 7.6 Mn	507 5.8 Mc
560[11.5 Fd	520 7.7 Ah	553 8.0 Md	545 10.1 L	535 7.7 Mn	508 5.9 Bc
RY HER	521 7.3 Jo	W LYR	T SER	535 7.0 Jo	508 5.9 GD
175519	523 8.0 Ws	181136	182306	535 7.1 L	508 5.6 Vh
481[12.7 Ch	523 7.9 Ah	474 12.4 An	511 10.0 Pt	536 7.4 Ad	508 5.7 Mc
496 13.7 L	524 8.1 Vh	488 12.2 An	511 10.2 Ch	537 7.6 Pt	508 5.9 Pt
509 13.5 Ma	527 7.5 Jo	497 10.6 L	512 10.5 Bw	537 7.2 Ko	509 5.8 Bc
511 13.8 Pt	527 8.5 Br	503 10.2 Be	514 9.4 Jo	538 7.4 Fd	509 5.8 Me
512[13.4 Bw	531 8.4 Fd	503 10.2 An	517 9.5 Jo	539 7.1 Jo	509 5.6 Oy
523 13.9 Mg	534 8.7 Jo	505 10.0 Jo	523 9.7 Mg	539 7.4 Ko	509 5.9 Ma
527 13.7 L	535 9.1 Bc	506 10.0 Ah	523 9.6 Jo	541 7.7 Mn	509 5.8 Pt
537[13.0 Pt	535 8.9 HS	510 10.0 Sf	527 9.7 Jo	543 7.1 Je	510 5.3 Be
540 12.8 Mp	535 9.2 Gy	510 9.9 Jo	532 9.8 Mp	544 7.7 Oy	510 5.9 Bc
544 12.0 L	536 8.5 GD	510 10.1 Wd	535 9.8 Jo	545 7.3 Jo	510 5.8 Wd
558 11.3 Fd	537 8.9 Pt	511 9.8 Pt	537 10.3 Pt	545 7.1 L	510 6.0 Ma
	538 8.8 L	513 9.6 Jo	538 10.1 Fd	545 7.3 Ko	510 5.3 Jo
	538 9.0 Fd	514 10.0 Wd	539 9.7 Jo	548 7.5 Ko	511 6.0 Bc

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
R SCT	R SCT	RW LYR	ST SGR	V LYR	RU LYR
184205	*184205*	184243	*185512a*	190529a	190941
511 5.7 Me	534 5.4 Fd	535 14.4 Lg	545 12.3 L	511 12.2 Pt	561[14.0 Br
511 5.4 Fd	534 5.8 Pt	544 14.2 Br	R CRA	525 11.0 Md	U DRA
511 5.8 Ma	534 5.5 Jo	Nov AQL	*185537a*	529 10.5 Ch	190967
511 5.9 Pt	535 5.8 Mg	184300	474 13.0 Sl	531 11.0 Md	497 12.0 L
512 5.7 Bg	535 5.9 Mc	504 10.4 Ma	478 13.3 Sl	537 10.0 Pt	511 11.7 Pt
512 5.9 Wd	535 5.9 Pt	506 10.6 Jo	485 12.9 Sl	539 10.2 Md	522 10.7 L
512 5.8 Ma	535 5.7 Mn	509 10.5 Ma	486 12.7 Ht	544 10.4 Br	528 10.7 Ch
512 5.4 Jo	535 5.4 Be	509 11.7 Pt	500 13.7 Sl	548 9.9 Md	537 10.3 Pt
512 5.8 Pt	535 5.3 L	510 10.6 Jo	506 13.5 Sl	RX SGR	538 10.0 L
513 5.7 Vh	535 5.3 Lg	511 10.9 Ch	T CRA	*190818*	544 10.4 Br
513 5.7 Mg	536 5.9 Pt	513 10.5 Jo	*185537b*	478 10.3 Ht	553 9.7 L
513 5.6 Fd	536 5.9 GD	517 10.6 Jo	474 13.0 Sl	486 10.5 Ht	560 9.1 Fd
513 5.9 Pt	537 5.8 Mc	527 10.5 Jo	478 13.3 Sl	500 10.6 L	W AQL
514 5.4 Lg	537 5.9 Pt	529 11.6 Pt	484 13.3 Sl	504 10.9 Ma	*191007*
514 5.8 Wd	537 5.4 Fd	534 11.6 Pt	500 13.5 Sl	509 11.0 Ma	500 12.2 L
514 5.7 Mg	538 5.9 Pt	535 10.4 Jo	506 13.3 Sl	511 11.5 Pt	519[12.4 L
516 5.8 Mg	539 5.7 Wd	536 11.8 Pt	Z LYR	528 12.2 Ch	528 12.8 Ch
517 5.7 Wd	539 5.5 Bc	539 10.5 Jo	185634	536 12.5 L	536 12.9 L
517 5.9 Ma	540 6.0 Mc	545 10.7 Jo	502 9.7 L	RW SGR	538[12.4 Fd
517 5.5 Jo	541 5.9 Bc	554 10.6 Jo	511 10.0 Pt	*190819a*	T SGR
518 5.3 Be	541 5.8 Mn	557 11.7 Pt	519 10.5 L	478 9.6 Ht	*191017*
518 5.9 Bc	543 5.7 Bg	558 10.7 Jo	528 10.6 Ch	486 9.6 Ht	511 11.6 Pt
518 5.9 Ma	543 5.4 Bc	RX LYR	537 10.8 Pt	500 9.6 L	528 11.8 Ch
518 5.6 Fd	544 5.8 Oy	185032	538 10.9 L	504 9.7 Ma	537 12.5 Pt
518 5.8 Pt	544 5.9 Bc	498 13.1 Ch	541 11.2 Br	509 9.8 Ma	569[11.8 Fd
519 5.0 L	545 5.3 Jo	511 14.0 Pt	SU SGR	511 9.4 Pt	R SGR
519 5.7 Pt	545 5.8 Pt	535[14.1 Lg	*185722*	519 9.9 L	*191019*
520 5.9 Pt	545 5.4 L	541[14.5 Br	478 8.7 Ht	528 10.4 Ch	478 8.0 Ht
521 5.8 Pt	546 5.8 Pt	R LYR	486 8.9 Ht	536 10.4 L	486 8.4 Ht
521 5.6 Wd	546 5.7 Bf	185243	RT LYR	537 10.6 Pt	504 8.9 L
521 5.3 Jo	546 5.6 Bc	499 4.1 Mc	185737	*190818b*	511 9.8 Pt
522 5.9 Ma	546 5.9 Mn	503 4.3 Oy	497 9.8 L	BH SGR	519 10.2 L
522 5.8 Pt	547 5.6 Pt	505 4.1 Mc	498 9.8 Ch	536 13.3 L	528 10.5 Ch
523 5.6 Mg	548 5.6 Bf	507 4.2 Mc	519 10.5 L	TY AQL	528 10.1 Ws
524 5.3 Fd	548 5.7 Wd	508 4.3 Mc	538 12.3 L	*190907*	529 10.0 Je
524 5.8 Pt	549 5.5 Jo	529 4.5 Mc	544 12.6 Br	511 10.4 Pt	529 11.0 Fd
525 5.7 Wd	550 5.5 Oy	531 4.2 Mc	V AQL	537 10.2 Pt	530 11.2 Za
526 5.7 Me	550 5.6 Pt	535 4.1 Mc	*185905*	538 10.4 Fd	532 11.3 Za
526 5.7 Pt	553 5.4 L	537 4.5 Mc	533 7.8 Mn	S LYR	536 11.2 L
526 5.0 Be	554 5.8 Wd	540 4.2 Mc	541 7.8 Mn	190925	537 11.0 Pt
527 5.0 L	555 5.5 Jo	544 4.0 Oy	546 7.8 Mn	539 14.8 L	538 10.0 Je
527 5.6 Mg	555 5.4 Pt	550 4.0 Oy	R AQL	544[13.8 Br	541 11.2 Za
527 5.8 Pt	557 5.9 Pt	S CRA	190108	561[13.8 Br	RY SGR
527 5.4 Jo	557 6.0 GD	*185437a*	500 11.0 Ch	X LYR	*191033*
527 5.5 Ch	557 5.4 Fd	474 12.2 Sl	509 11.2 Ah	190926	478 11.8 Ht
528 5.8 GD	558 5.7 Jo	478 11.7 Sl	511 11.4 Pt	511 8.6 Pt	484 12.1 En
529 5.5 Bg	558 5.7 Pt	478 11.6 Ht	515 11.3 Ah	537 8.9 Pt	485 12.0 Bl
529 5.5 Me	559 5.8 Pt	485 12.1 Sl	527 10.3 Ws	RS LYR	486 11.6 Ht
529 6.0 Mc	559 6.1 Mc	486 11.5 Ht	528 11.3 Ch	190933a	499 12.1 En
529 5.9 Pt	559 5.5 Fd	499 11.9 En	531 11.1 Za	497 14.0 L	500 12.1 L
531 5.5 Mc	560 5.9 Pt	500 11.7 Sl	532 11.0 Mn	538 14.5 L	500 12.1 Sl
531 5.2 Fd	561 5.9 Pt	504 12.5 En	535 10.9 Mn	544[14.1 Br	502 11.7 L
531 5.8 Pt	563 5.8 GD	506 12.5 Sl	537 10.8 Pt	555[13.8 Br	503 11.8 En
532 5.7 Pt	564 5.5 Pc	ST SGR	538 10.5 Fd	561[14.1 Br	506 11.3 En
533 5.5 Me	564 5.8 Mc	*185512a*	541 10.7 Mn	RU LYR	506 11.9 L
533 5.8 Pt	569 5.5 Fd	502[14.0 L	541 10.4 Za	190941	510 11.3 Bl
533 5.8 Mn	569 5.9 Mc	528[12.5 Ch	569 8.7 Fd	544[14.0 Br	511 11.0 En
534 5.7 Wd		535 13.5 L		556[14.0 Br	513 11.5 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
RY SGR	U LYR	R CYG	RT CYG	χ CYG	RR TEL
191033	191637	193449	194048	194632	*195656*
518 11.6 Pt	560 10.5 Fd	540 10.4 Mc	539 7.4 Jo	520 9.5 Ah	478[12.6 Ht
526 10.9 Ch	564 10.5 Fd	542 11.9 Jo	539 7.2 Wd	521 9.7 Jo	506[12.6 En
527 10.7 L	AF CYG	548 11.3 Wd	542 7.7 Jo	521 9.5 Wd	Z CYG
529 11.7 Pt	192745	549 11.6 Jo	547 8.0 Ah	526 8.8 Bg	195849
531 11.7 Pt	506 6.8 Ah	554 11.0 Wd	548 8.0 Wd	527 9.6 Jo	501 14.1 L
532 11.7 Pt	509 6.9 Ah	554 10.5 Jo	549 7.7 Jo	529 9.3 Ch	510 13.2 Ch
533 11.7 Pt	515 6.9 Ah	556 11.0 Br	554 8.5 Wd	529 8.8 Bg	512 13.0 Pt
534 11.6 Pt	518 6.9 Ah	558 10.0 Jo	558 8.5 Jo	532 10.1 Je	538 12.4 Pt
535 11.3 L	520 7.1 Ah	559 10.0 Cy	560 8.4 Fd	533 8.7 Bg	538 13.8 L
536 11.4 L	523 7.1 Ah	560 10.3 Fd	564 8.9 Mc	534 9.2 Wd	561 11.2 Br
537 11.7 Pt	532 7.1 Ah	564 9.8 Ad	569 9.1 Mc	535 10.2 Jo	S TEL
538 11.7 Pt	535 7.3 Ah	564 9.8 Mc	TU CYG	538 8.7 Pt	*195855*
538 11.4 L	544 7.3 Ah	569 9.6 Mc	194348	539 8.8 Bg	478[12.6 Ht
539 11.7 L	547 7.2 Ah	RV AQL	497 10.9 L	539 9.3 Wd	506[12.6 En
545 11.0 L	TY CYG	193509	500 10.9 Ch	539 9.9 Jo	SY AQL
547 11.5 Pt	192928	502 11.4 L	510 10.0 Ma	544 9.1 Br	200212
552 9.9 L	500 10.6 Ch	512 12.3 Pt	510 10.7 Jo	544 8.7 Bg	502 14.8 L
552 9.9 Be	502 10.5 L	516 12.8 Mg	512 10.4 Pt	545 9.7 Jo	536 13.8 L
557 11.0 Pt	510 10.8 Ch	519 12.6 L	513 9.9 Jo	547 8.7 Bg	540[12.5 Be
558 10.7 Pt	511 11.3 Pt	536 13.5 L	517 9.5 Jo	547 9.0 Ah	541 14.0 Br
559 10.6 Pt	522 11.5 L	538 14.2 Pt	521 9.0 Jo	548 8.2 Wd	563[12.7 Bg
560 10.7 Pt	537 12.0 Pt	556[13.3 Br	526 8.9 Jo	554 8.0 Wd	S CYG
561 10.8 Pt	538 12.1 L	561[13.3 Br	535 8.8 Jo	554 9.7 Jo	200357
TY SGR	539 12.7 Sj	T PAV	536 9.3 L	556 8.5 Bg	510[13.3 Ch
191124	544 12.0 Br	*193072*	538 8.9 Pt	562 8.2 Bg	529[12.3 Md
506 12.4 En	559 11.2 Sj	478 7.4 Ht	539 8.8 Jo	565 7.7 Bg	561[14.3 Br
S SGR	574 12.1 Sj	486 7.3 Ht	542 8.9 Jo	566 7.2 Bg	R CAP
191319a	RT AQL	486 7.3 En	549 8.8 Jo	S PAV	*200514*
478[12.7 Ht	193311	499 8.0 En	553 9.3 L	*194639*	502 13.5 L
486[12.7 Ht	500 11.3 L	504 7.9 En	556 9.1 Br	478 7.0 Sl	536 12.8 L
528 12.9 Ch	504 10.6 Ma	RT CYG	558 9.0 Jo	486 7.0 En	S AQL
536[14.4 L	509 10.6 Ma	194048	X AQL	499 7.4 En	200715a
Z SGR	511 10.3 Pt	500 7.7 Ch	194604	504 7.4 En	508 11.4 Be
191321	511 10.2 Ch	505 7.4 Jo	500 13.8 L	RU SGR	508 11.4 An
536 14.1 L	519 9.3 L	506 7.4 Ah	511 11.6 Fd	*195142*	511 10.3 Jo
TZ CYG	520 9.4 Ah	509 7.5 Ah	522 13.0 L	478 10.6 Ht	512 11.4 Pt
191350	536 8.3 L	510 7.5 Wd	538 12.6 Pt	484 10.3 En	517 10.0 Jo
511 10.2 Pt	537 8.6 Pt	510 7.2 Jo	538 12.6 L	486 10.3 Ht	521 9.7 Jo
537 10.0 Pt	547 8.9 Ah	511 7.2 Fd	555 12.5 Jo	499 8.2 En	521 10.0 Ch
U LYR	553 8.4 L	512 7.2 Pt	556 12.5 Br	RR AQL	526 9.7 Me
191637	556 8.5 Br	513 7.4 Fd	559 12.2 Jo	*195202*	528 9.5 Jo
505 10.2 Jo	R CYG	513 7.4 Jo	569 10.6 Sf	500 12.9 L	535 9.2 Jo
510 9.9 Jo	193449	514 7.8 Wd	569 11.3 Mc	536 13.8 L	538 10.0 Pt
511 11.0 Fd	508 11.4 Mc	514 7.4 Ah	χ CYG	556 13.8 Br	539 9.2 Jo
511 10.9 Pt	509 13.7 Ma	517 7.3 Jo	194632	RS AQL	545 9.3 Jo
513 9.9 Jo	510 13.2 Ch	518 7.3 Ah	500 10.5 Ch	*195308*	554 9.8 Jo
513 10.5 Fd	512 13.5 Pt	520 7.4 Ah	503 10.3 Be	500 12.9 L	563 9.4 Bg
517 9.8 Jo	526 12.5 Jo	521 7.0 Wd	503 10.4 An	522 12.2 L	RW AQL
521 9.8 Jo	528 12.3 Jo	521 7.2 Jo	507 10.0 Jo	538 10.4 L	200715b
524 10.3 Fd	529 11.0 Mc	523 7.4 Ah	510 9.7 Ma	553 9.0 L	511 9.5 Jo
529 10.8 Fd	531 10.7 Mc	524 7.0 Ch	510 9.6 Wd	Nov CYG	512 9.5 Pt
531 10.5 Fd	534 11.0 Wd	526 7.5 Jo	511 9.8 Jo	195553	517 9.5 Jo
534 10.7 Jo	535 10.8 Mc	527 7.3 Fd	512 10.0 Pt	510[13.2 Ch	521 9.6 Jo
537 10.5 Pt	535 12.3 Jo	535 8.4 Mc	512 10.1 Je	533[12.2 Pt	528 9.8 Jo
538 10.8 Fd	537 10.6 Mc	535 7.5 Jo	513 9.8 Jo	545[12.2 Pt	535 9.4 Jo
539 10.6 Jo	538 12.5 Pt	535 7.5 Ah	517 9.7 Jo	557[12.2 Pt	538 9.3 Pt
545 10.4 Jo	539 11.0 Wd	537 8.1 Mc	517 9.5 Ch		539 9.2 Jo
549 10.2 Jo	539 12.0 Jo	538 7.5 Pt	517 9.6 Mg		545 9.3 Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs. J.D.Est.Obs.

RW AQL
200715b
558 9.8 Jo
RU AQL
200812
502 11.7 L
509 10.6 Ma
519 10.2 L
521 9.8 Ch
538 9.3 L
541 9.2 Br
553 9.5 L
Z AQL
200906
508 11.0 Be
508 11.0 An
512 10.6 Pt
538 10.9 Pt
565 11.2 Bg
R SGE
200916
511 10.0 Jo
517 10.2 Jo
521 10.3 Jo
528 10.4 Jo
535 9.9 Jo
539 10.1 Jo
545 10.2 Jo
558 10.4 Jo
RS CYG
200938
500 8.9 Ch
502 8.1 L
505 7.8 Jo
507 7.5 Je
508 8.0 GD
510 8.2 Wd
510 7.7 Jo
511 8.8 Ch
512 7.8 Pt
513 8.0 Jo
514 8.2 Je
517 8.0 Jo
519 7.8 L
521 7.9 Jo
521 8.8 Ch
521 8.7 Wd
526 8.5 Ch
528 8.6 GD
528 8.0 Jo
531 8.0 Je
532 8.2 Je
534 8.9 Wd
535 8.9 HS
535 7.8 Jo
538 8.0 Pt
538 8.2 L
539 8.0 Jo
539 8.9 Wd
542 8.1 Jo

RS CYG
200938
542 8.9 HS
545 8.9 HS
545 8.2 L
548 8.6 Wd
554 8.8 Wd
554 8.2 Jo
558 8.4 Jo
559 8.5 Jo
R DEL
201008
500 12.3 L
512 12.7 Pt
522 12.3 L
538 13.0 Pt
538 12.1 L
541 13.0 Br
558[11.6 Fd
RT CAP
201121
512 6.6 Pt
538 6.6 Pt
SX CYG
201130
510 12.2 Ch
512 12.6 Pt
538 12.4 Pt
556 12.9 Br
WX CYG
201437b
502 9.6 L
505 8.9 Jo
510 9.0 Jo
510 9.3 Ch
512 9.5 Pt
513 9.0 Jo
517 9.0 Jo
519 9.2 L
521 9.3 Jo
525 10.4 Md
528 9.3 Jo
533 10.6 Md
535 8.9 Jo
538 9.2 Pt
538 9.3 L
539 8.9 Jo
541 10.3 Md
542 9.0 Jo
545 9.1 L
554 9.1 Jo
557 10.6 Bg
558 9.3 Jo
V SGE
201520
541 11.5 Br
563 11.1 Bg
U CYG
201647
487 9.8 Mn

U CYG
201647
501 9.7 Mn
505 10.0 Wd
505 10.1 Mc
505 9.0 Jo
508 10.0 Mc
509 10.0 Mn
510 10.0 Sf
510 10.0 Wd
511 8.8 Jo
512 8.6 Pt
513 9.0 Jo
513 9.7 Fd
514 9.9 Wd
517 9.8 Wd
517 9.1 Jo
521 10.0 Wd
521 9.8 Ch
522 9.4 Jo
524 9.9 Fd
526 9.5 Jo
527 9.9 Fd
527 8.9 Ws
528 10.3 Md
529 9.9 Fd
529 9.8 Mc
530 10.4 Mn
531 9.7 Mc
533 10.6 Md
534 10.3 Sf
534 10.0 Wd
535 9.8 Mc
535 9.0 Jo
537 9.9 Mc
537 9.9 Fd
538 9.0 Pt
539 10.3 Sf
539 10.2 Wd
539 9.0 Jo
540 10.6 Md
540 10.1 Mc
541 10.2 Mn
545 9.1 Jo
548 9.7 Md
548 9.6 Wd
549 9.2 Jo
553 10.3 Md
554 9.5 Jo
554 9.8 Wd
557 10.6 Sf
559 9.5 Mc
564 9.9 Mc
569 9.9 Mc
569 10.6 Sf
Z DEL
202817
502 8.7 L
509 9.4 Ma
512 9.5 Pt

Z DEL
202817
519 9.5 L
529 10.0 Md
534 10.1 Md
538 10.0 Pt
538 9.8 L
540 10.1 Md
541 10.2 Br
553 11.0 L
ST CYG
202954
501 11.1 L
510 10.9 Ch
512 10.9 Pt
522 11.7 L
525 11.4 Md
531 11.5 Md
538 11.1 Pt
538 11.7 L
539 11.4 Md
545 11.8 Md
561 12.0 Br
V VUL
203226
512 8.6 Pt
538 9.0 Pt
Y DEL
203611
502 13.8 L
509 13.9 Ma
536 13.5 L
541 13.9 Br
S DEL
203816
512 9.0 Pt
526 9.2 Ws
529 9.7 Md
534 10.2 Md
538 11.3 Pt
540 10.0 Md
555 11.0 Md
557 11.2 Bg
V CYG
203847
501 12.5 L
521 12.3 Ch
522 12.5 L
538 13.3 Pt
538 13.5 L
561 13.3 Br
Y AQR
203905
517[12.3 Fd
555 12.5 Jo
558 12.2 Jo
T DEL
204016
502 14.1 L
508[12.9 An

T DEL
204016
529[13.0 Be
536 14.2 L
537[12.0 Fd
541[14.3 Br
561[14.3 Br
V AQR
204102
502 8.5 L
512 8.5 Pt
519 8.6 L
529 8.8 Md
538 8.5 Pt
538 8.6 L
539 9.0 Md
549 9.2 Md
553 9.0 Md
553 8.8 L
W AQR
204104
502 8.8 L
519 8.8 L
538 9.0 L
553 9.3 L
U CAP
204215
502 13.7 L
536 11.3 L
545 11.3 L
V DEL
204318
517[14.4 Ma
541[14.6 Br
561[14.4 Br
557[13.1 Bg
T AQR
204405
517[12.7 Fd
538 13.5 Pt
555 12.0 Jo
558 11.5 Jo
RZ CYG
204846
511 12.2 Fd
512 11.8 Pt
529 12.0 Fd
538 12.0 Pt
S IND
204954
478[13.1 Ht
486 13.1 Ht
X DEL
205017
502[14.4 L
536 14.3 L
538 13.3 Pt
541 13.4 Br

R VUL
205923a
510 12.0 Jo
512 12.5 Pt
538 13.1 Pt
V CAP
210124
536 11.4 L
545 10.3 L
TW CYG
210129
501 10.5 L
519 10.4 L
528 9.6 Md
533 9.6 Md
540 9.7 Md
543 10.1 L
544 10.5 Br
548 11.0 Md
X CEP
210382
471[13.9 Br
527[14.6 Br
541[14.6 Br
561[14.6 Br
RS AQR
210504
502 10.8 L
519 10.1 L
512 10.7 Pt
538 10.2 Pt
541 10.7 L
Z CAP
210516
545 10.5 L
R EQU
210812
502 10.6 L
509 10.7 Ma
512 10.0 Pt
519 9.8 L
538 9.9 Pt
541 10.3 Br
541 9.8 L
542 10.0 Md
549 10.7 Md
T CEP
210868
500 11.2 Ch
502 10.3 Mn
505 9.8 Jo
509 10.3 Ch
510 9.8 Jo
511 10.8 Fd
512 10.0 Jo
512 10.4 Mn
512 10.5 Wd
513 10.1 Fd
513 10.3 Pt
515 10.4 Ch

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.	J.D.Est.Obs.
T CEP	Y CAP	RR PEG	S LAC	V CAS	R AQR
210868	*212814*	214024	222439	230759	*233815*
517 10.0 Jo	506 14.5 L	558 9.0 Fd	501 12.3 L	523 8.7 Ah	545 8.0 Pt
520 10.3 Ch	541 14.6 L	559 9.1 Fd	518 11.0 Pt	545 9.8 Pt	549 8.2 Jo
521 10.1 Jo	W CYG	561 9.3 Br	522 10.5 L	547 9.9 Ah	Z CAS
521 10.3 Wd	213244	569 9.5 Fd	538 9.3 Pt	555 9.8 Jo	233956
524 10.3 Fd	486 6.1 Kd	R GRU	538 9.2 Ko	557 10.2 Bg	501 11.3 L
527 10.0 Jo	496 6.3 L	*214247*	539 9.3 L	558 10.3 Jo	522 11.9 L
530 10.7 Mn	506 6.2 L	478 12.6 Ht	541 9.0 Ko	W PEG	534 12.3 Fd
532 10.6 Ch	522 6.5 L	486 12.6 Ht	542 9.2 Md	231425	539 12.4 L
533 10.4 Mn	529 6.2 Mc	V PEG	545 8.7 Ko	501 8.6 L	RR CAS
534 10.1 Wd	531 6.0 Mc	215605	546 9.0 Th	517 8.8 Fd	235053
535 10.3 Gy	532 6.7 L	506 14.2 L	547 8.8 Ah	517 8.2 Jo	467 11.3 Bn
535 9.8 Jo	535 6.1 Mc	541 14.3 Br	547 8.8 Ko	521 8.0 Jo	505 13.4 Bn
537 10.6 Mn	545 6.5 L	541 14.4 L	559 9.0 Al	522 8.7 L	510 13.2 Bn
537 10.0 Fd	550 6.2 Og	U AQR	R LAC	535 8.4 Jo	R CAS
538 10.0 Pt	564 6.5 Mc	*215717*	223841	539 9.1 L	235350
539 10.2 Wd	569 6.3 Mc	506 13.0 L	501 9.1 L	543 8.4 Jo	506 8.2 Jo
541 10.3 Mn	S CEP	513 13.0 Pt	518 8.8 Pt	545 8.7 Jo	510 8.5 Jo
545 9.7 Jo	213678	541 13.8 L	522 8.6 Pt	554 8.8 Jo	511 9.1 Jo
546 10.2 Mn	510 9.8 Je	545 13.8 Pt	538 8.8 Pt	558 8.9 Jo	515 9.1 Ah
546 9.7 Bc	513 11.6 Pt	RY PEG	539 9.0 L	559 8.9 Ah	517 8.5 Jo
548 12.0 Bf	529 11.2 Md	220133a	RW PEG	S PEG	518 9.1 Ah
548 10.0 Wd	530 11.3 Wr	538 10.8 Fd	225914	231508	521 8.6 Jo
549 9.3 Jo	538 10.8 Pt	RZ PEG	502 10.2 L	502 11.1 L	523 9.2 Ah
554 9.8 Wd	539 11.0 Md	220133b	510 10.0 Ma	518 12.1 Pt	527 8.7 Jo
555 9.2 Jo	543 10.2 Je	501 9.4 L	518 10.2 Pt	522 11.4 L	531 9.4 Je
557 9.4 Fd	545 10.6 Th	513 10.5 Pt	522 9.8 L	539 11.5 L	535 8.7 Jo
558 9.0 Jo	553 11.0 Md	522 10.1 L	529 10.3 Fd	540 10.3 Mc	536 9.6 Mn
569 9.5 Fd	561 10.0 Br	538 11.2 Pt	539 10.5 L	545 12.0 Pt	538 9.4 Je
RR AQR	RU CYG	543 11.5 L	545 11.0 Pt	Z AND	539 9.9 Wd
210003	213753	T PEG	553 11.6 L	232848	542 9.5 Mn
506 14.0 L	506 7.8 Ah	220412	β PEG	518 10.1 Pt	544 9.4 Je
513 13.5 Pt	508 9.0 Mc	502 9.9 L	225927	526 10.6 Me	545 8.8 Jo
536 13.8 L	513 7.8 Pt	522 11.4 L	529 2.5 Mc	534 10.6 Fd	548 9.9 Wd
538 12.6 Pt	518 8.0 Ah	543 11.6 L	531 2.6 Mc	545 10.4 Pt	555 9.0 Jo
545 13.2 L	520 8.1 Ah	561 13.1 Br	537 2.3 Mc	565 10.6 Bg	557 10.0 Bg
Y PAV	523 8.1 Ah	Y PEG	540 2.2 Mc	ST AND	559 9.1 Jo
211570	529 9.5 Mc	220613	R PEG	233335	Z PEG
478 5.6 Ht	538 8.2 Pt	518 13.2 Pt	230110	517 9.2 Fd	235525
486 5.8 Ht	RV CYG	561[13.7 Br	518 10.5 Pt	518 9.8 Pt	506 10.2 L
X PEG	213937	RS PEG	520 10.1 Ah	538 9.7 Fd	518 10.0 Pt
211614	513 6.8 Pt	220714	527 9.1 Ws	545 9.4 Pt	536 11.3 L
502 12.2 L	538 6.3 Pt	502 13.3 L	532 9.0 We	558 9.7 Fd	545 11.7 Pt
509 11.2 Ma	RR PEG	518 12.7 Pt	545 7.9 Pt	559 10.2 Al	Y CAS
513 11.2 Pt	214024	522 13.0 L	547 8.1 Ah	569 9.9 Fd	235855
519 10.8 L	513 9.3 Pt	538 11.6 Pt	565 8.1 Bg	R AQR	501 11.8 L
536 10.6 L	527 9.0 Fd	543 11.3 L	V CAS	*233815*	522 12.4 L
538 10.1 Pt	529 8.6 Fd	555 9.8 Md	230759	502 8.4 L	539 12.7 L
541 10.0 Br	534 8.8 Fd	RV PEG	506 8.0 Ah	510 7.9 Ma	SV AND
545 9.9 L	537 8.9 Fd	222129	512 8.2 Ah	518 7.8 Pt	235939
T CAP	538 9.0 Fd	502 11.2 L	515 8.4 Ah	528 7.8 Ws	518 12.8 Pt
211615	538 9.2 Pt	522 12.7 L	518 8.2 Pt	538 7.8 L	518 12.8 Pt
507 13.8 L	542 9.2 Md	543 13.1 L	519 8.6 Ah	545 8.0 L	534[12.3 Fd
541 13.1 L	555 9.2 Md	561 13.5 Br	520 8.6 Ah	545 8.0 Jo	545 12.5 Pt

RAPIDLY VARYING IRREGULAR VABIABLES.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
005840 RX ANDROMEDAE—						
	6513.8	12.6	Pt	6557.7	12.4	Pt
	6518.9	11.6	Pt	6558.7	11.3	Pt
	6536.7	12.2	Pt	6559.7	11.7	Pt
	6545.9	12.7	Pt	6560.7	11.8	Pt
	6546.9	11.5	Pt	6561.7	11.8	Pt
	6547.9	11.4	Pt	6561.9	12.6	Br
060547 SS AURIGAE—						
	6475.1	[13.3	Ch	6536.6	[11.0	L
	6479.1	[13.3	Ch	6538.6	[12.0	L
	6482.1	[13.7	Ch	6541.6	[13.0	L
	6495.4	[12.5	L	6545.6	14.5	L
	6496.4	[12.5	L	6546.9	[12.6	Pt
	6497.4	[12.5	L	6547.9	[12.6	Pt
	6503.4	[12.5	L	6553.6	[12.5	L
	6504.4	[12.5	L			
074922 U GEMINORUM—						
	6469.9	[13.3	Sl	6494.5	[12.4	Sl
	6471.7	[13.3	Br	6496.1	[13.3	Ch
	6482.1	[13.7	Ch	6499.9	[12.4	Sl
081473 Z CAMELOPARDALIS—						
	6471.7	12.7	Br	6514.7	11.3	Vh
	6479.7	11.2	Vh	6519.4	11.3	L
	6480.7	11.3	Vh	6522.4	12.1	L
	6481.7	11.4	Vh	6527.4	12.6	L
	6482.7	11.6	Vh	6528.4	12.9	L
	6483.8	11.7	Vh	6528.8	12.1	Vh
	6484.7	11.9	Vh	6529.7	12.6	Vh
	6485.8	11.9	Vh	6529.7	12.7	Bg
	6486.7	12.0	Vh	6532.4	13.0	L
	6487.9	12.2	Vh	6533.7	12.9	Bg
	6488.9	11.9	Vh	6534.4	12.9	L
	6489.7	12.0	Vh	6535.4	12.9	L
	6495.4	12.3	L	6536.6	11.8	L
	6496.4	13.0	L	6536.7	11.7	Me
	6497.4	13.0	L	6537.4	10.6	L
	6497.7	12.4	Vh	6538.6	10.6	L
	6498.4	12.3	L	6538.8	11.0	Me
	6498.7	11.4	Vh	6539.4	10.8	L
	6499.8	10.8	Vh	6539.7	10.9	Bg
	6500.5	10.6	L	6541.6	11.2	L
	6500.7	10.8	Vh	6541.8	11.1	Bg
	6501.6	10.7	L	6543.4	11.4	L
	6501.8	10.9	Vh	6543.7	11.2	Bg
	6502.5	10.6	L	6544.4	11.3	L
	6502.7	11.0	Vh	6544.7	11.8	Bg
	6503.4	10.8	L	6545.4	11.4	L
	6503.7	11.2	Vh	6545.6	11.8	L
	6504.4	11.3	L	6545.7	12.0	Bg
	6504.7	11.4	Vh	6547.7	12.2	Bg
	6505.7	11.5	Vh	6549.7	12.1	Bg
	6506.5	11.7	L	6550.7	12.1	Bg
	6506.7	11.7	Vh	6552.4	10.9	L
	6507.7	11.7	Vh	6552.4	10.9	Be
	6508.7	11.9	Vh	6553.4	11.0	Be
	6509.7	12.1	Me	6553.4	11.0	L
	6510.7	12.1	Me	6553.7	11.1	Bg
	6510.8	12.0	Vh	6554.3	11.1	L
	6512.7	11.7	Vh	6554.3	11.1	Be
	6513.7	11.5	Vh	6556.7	11.6	Bg
081473 Z CAMELOPARDALIS—						
	6557.7	12.0	Bg	6561.7	12.0	Pt
	6558.7	11.9	Pt	6562.7	12.0	Bg
	6559.7	12.2	Bg	6563.7	12.1	Bg
	6559.7	12.0	Pt	6565.7	12.0	Bg
	6560.7	12.4	Bg	6566.7	11.8	Bg
	6560.7	12.1	Pt			
094512 X LEONIS—						
	6471.7	[13.3	Br	6509.7	[13.0	Pt
	6474.4	12.2	An			
202946 SZ CYGNI—						
	6509.7	9.1	Pt	6537.7	9.0	Pt
	6511.7	9.5	Pt	6538.7	9.6	Pt
	6512.7	9.6	Pt	6545.9	9.7	Pt
	6513.8	9.6	Pt	6546.9	9.4	Pt
	6518.9	9.2	Pt	6547.7	9.3	Pt
	6519.7	9.0	Pt	6550.7	9.0	Pt
	6529.7	9.6	Pt	6557.7	9.6	Pt
	6531.7	9.5	Pt	6558.7	9.5	Pt
	6532.7	9.4	Pt	6559.7	9.6	Pt
	6533.7	9.1	Pt	6560.7	9.6	Pt
	6534.7	8.9	Pt	6561.7	9.3	Pt
	6536.7	8.9	Pt			
213843 SS CYGNI—						
	6483.7	11.9	Ma	6510.7	8.6	Bc
	6488.8	9.7	Ma	6510.7	8.6	Me
	6495.4	10.8	L	6511.4	8.5	Ah
	6496.4	11.3	L	6511.4	8.2	Be
	6496.7	11.7	Ma	6511.6	8.6	Jo
	6500.6	11.5	L	6511.7	8.2	Fd
	6501.4	11.9	An	6511.7	8.3	Bc
	6501.4	12.0	Be	6511.7	8.6	Pt
	6501.4	11.7	L	6511.9	8.6	Me
	6501.8	11.9	Ma	6512.4	8.4	Ah
	6502.4	12.0	Be	6512.6	8.0	Jo
	6502.6	11.5	L	6512.6	8.3	Wd
	6503.4	11.8	An	6512.7	8.2	Bb
	6503.4	11.9	Be	6512.7	8.4	Sd
	6504.9	11.5	Ma	6512.7	8.5	Pt
	6505.6	11.8	Jo	6512.7	8.4	Mg
	6505.8	11.1	Ma	6512.9	8.4	Ws
	6506.5	11.3	Ah	6513.4	8.2	Be
	6506.5	10.7	L	6513.6	8.1	Fd
	6506.6	11.6	Jo	6513.7	8.4	Jo
	6506.7	11.8	Bc	6513.7	8.3	Mg
	6507.7	12.0	Bc	6513.7	8.1	Bb
	6508.4	10.8	Be	6513.8	8.6	Bb
	6509.4	10.8	An	6513.8	9.6	Pt
	6508.7	9.5	Bc	6514.4	8.3	Ah
	6509.4	8.7	Ah	6514.6	8.4	Lg
	6509.4	8.3	An	6514.6	8.4	Wd
	6509.4	8.5	Be	6514.7	8.3	Mg
	6509.7	8.6	Bc	6514.7	8.6	Bb
	6509.7	8.7	Me	6514.8	8.4	Jo
	6509.7	8.4	Pt	6514.8	8.5	Me
	6509.8	8.5	Ma	6515.4	8.4	Be
	6510.2	8.5	Ch	6515.5	8.4	Ah
	6510.4	8.5	Be	6515.7	8.3	Mg
	6510.6	8.2	Wd	6516.7	8.3	Mg
	6510.6	8.5	Jo	6517.6	8.6	Jo

VARIABLE STAR OBSERVATIONS RECEIVED DURING JULY AND AUGUST, 1931.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
213843 SS CYGNI—							213843 SS CYGNI—						
	6517.6	8.4	Wd	6527.5	11.8	L		6535.7	11.6	Mg	6550.7	11.7	Pt
	6517.7	8.6	Mg	6527.7	11.0	Fd		6536.4	11.6	Be	6550.7	11.9	Bg
	6517.7	8.4	Bc	6527.7	11.7	Jo		6536.6	11.8	L	6552.4	11.6	Be
	6517.7	8.2	Fd	6527.8	11.6	Br		6536.7	11.6	Me	6552.4	11.7	L
	6517.8	8.7	Ma	6527.8	12.0	Ws		6536.7	11.7	Pt	6553.4	11.7	L
	6518.4	8.4	Be	6527.8	11.5	Mg		6537.6	11.5	Bc	6553.4	11.6	Be
	6518.5	8.7	Ah	6528.2	11.9	Ch		6537.7	11.0	Fd	6553.7	12.0	Bg
	6518.7	8.2	Fd	6528.4	11.4	L		6537.7	11.8	Pt	6554.3	11.6	Be
	6518.7	8.6	Ma	6528.6	11.8	Jo		6538.6	11.4	L	6554.3	11.6	L
	6518.9	8.9	Pt	6528.7	11.0	GD		6538.7	11.7	Pt	6554.6	11.3	Wd
	6519.4	8.7	Ah	6528.8	11.8	Vh		6538.7	11.2	Fd	6554.6	11.8	Jo
	6519.5	8.9	L	6528.8	12.0	Ws		6539.4	11.4	L	6555.6	11.8	Jo
	6519.7	8.9	Pt	6529.4	11.4	Be		6539.5	11.5	Md	6556.7	11.9	Bg
	6520.4	9.2	Ah	6529.6	11.6	Fd		6539.6	11.8	Wd	6557.6	11.6	Fd
	6520.7	8.7	Fd	6529.7	11.6	Bg		6539.6	11.8	Jo	6557.7	11.7	Pt
	6520.7	9.7	Jo	6529.7	11.6	Me		6539.6	12.0	Bc	6557.7	11.9	Bg
	6521.2	9.5	Ch	6529.7	11.6	Pt		6539.6	11.7	Bf	6558.6	12.0	Jo
	6521.4	9.7	Ah	6529.7	11.8	Vh		6539.7	11.2	Bg	6558.7	11.8	Fd
	6521.4	9.9	Be	6530.6	11.8	Md		6540.4	11.8	Be	6558.7	11.7	Pt
	6521.6	10.0	Jo	6530.7	11.7	Bg		6541.5	10.5	L	6559.6	11.8	Jo
	6521.6	9.9	Wd	6530.8	11.7	Me		6541.6	10.5	Bc	6559.6	11.9	Al
	6521.7	9.8	Ol	6531.6	11.4	Fd		6541.8	11.2	Bg	6559.7	12.0	Cy
	6522.6	10.2	Jo	6531.7	11.7	Pt		6543.4	11.6	L	6559.7	11.7	Pt
	6522.5	10.1	L	6531.7	11.8	Vh		6543.7	11.2	Bg	6559.7	11.8	Fd
	6522.7	10.2	Ma	6532.4	11.4	L		6544.6	12.0	Bc	6559.7	11.8	Bg
	6522.8	10.0	Ol	6532.4	11.8	Ah		6544.7	11.4	Bg	6560.7	11.7	Pt
	6523.4	10.7	Ah	6532.7	11.7	Pt		6545.4	11.5	L	6560.7	11.6	Bg
	6523.6	10.5	Jo	6533.7	11.5	Bg		6545.6	12.0	Jo	6561.7	11.7	Pt
	6523.7	10.2	Mg	6533.7	11.8	Me		6545.7	11.7	Bg	6561.7	11.7	Bg
	6523.8	10.9	Ws	6533.7	11.5	Sd		6545.9	11.6	Pt	6561.7	11.9	Ma
	6524.4	10.1	Be	6534.4	11.1	Md		6546.6	12.0	Bc	6562.7	11.7	Bg
	6524.6	10.6	Fd	6534.4	11.5	L		6546.8	12.0	Md	6563.7	11.9	Bg
	6524.7	11.1	Mg	6534.6	11.0	Wd		6546.9	11.6	Pt	6564.7	11.9	Pc
	6524.7	11.0	Sd	6534.6	11.8	Jo		6547.4	11.6	Be	6565.7	11.8	Bg
	6525.7	11.6	Md	6534.7	11.7	Pt		6547.7	11.9	Bg	6566.7	11.9	Bg
	6526.4	11.8	Be	6534.7	11.9	Fd		6547.7	11.7	Pt	6566.7	11.7	Pc
	6526.7	11.6	Bg	6535.4	11.6	L		6548.6	11.9	Wd	6567.7	11.8	Bg
	6526.7	11.9	Ws	6535.6	11.7	Lg		6548.6	12.0	Bf	6569.6	11.9	Fd
	6526.7	11.5	Jo	6535.6	11.3	Jo		6549.6	11.8	Jo	6569.7	11.9	Ma
	6526.7	11.4	Me	6535.7	11.5	Sd		6549.7	11.9	Bg			

SUMMARY OF OBSERVATIONS FOR JULY AND AUGUST, 1931.

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Ahnert	Ah	36	157	Chandra	Ch	124	186
Aldwell	Ad	6	16	Cilley	Cy	1	1
Allen, P. R.	Al	3	3	Ensor	En	74	284
Ancarani	An	12	26	Ford	Fd	66	190
Baldwin	Bl	64	174	Godfrey Club	GD	11	32
Beery	By	2	4	Gregory	Gy	11	11
Benini	Be	22	67	Haas	HS	12	37
Bigelow	Bw	5	5	Hildom, A.	Hi	6	13
Brocchi	Br	61	82	Hildom, L.	Hl	2	3
Brown, A. N.	Bn	3	12	Houghton	Ht	68	145
Brown, R.	Bb	1	4	Jansen	Je	8	24
Buckstaff, E.	Bf	5	8	Jones	Jo	67	465
Buckstaff, R.	Bc	12	45	Konda	Kd	16	58
Bunting	Bg	23	80	Kohman	Ko	9	59

Observer	Initial	Vars.	Observations	Observer	Initial	Vars.	Observations
Lacchini	L	163	496	Shinkfield	Sl	36	125
Logan	Lg	6	8	Shultz	Sz	7	14
Marsh	Ma	33	93	Simpson	Si	2	6
McLeod	Mc	27	128	Smith, F. W.	Sf	7	30
McPherson	Mp	10	18	Stearns	Sj	3	8
Meek	Me	12	28	Theile	Th	12	26
Mennella	Mn	19	66	Vorhies	Vh	21	80
Millard	Md	22	78	Wares	Ws	16	25
Monnig	Mg	23	53	Webb	Wd	20	114
O'Byrne	Oy	8	23	Wetherbee	We	4	8
Olcott	Ol	1	2	Wright	Wr	3	4
Proctor	Pc	10	11	Zaldo	Za	5	11
Peltier	Pt	164	435				
Sanders	Sd	8	11	Totals	54	403	4092

and Japan as well. We are eagerly looking forward to hearing and seeing some of the experiences of his trip at the meeting of the Association to be held on October 17 at Harvard Observatory in Cambridge.

RY Sagittarii, 1910*33*, has increased considerably in brightness since it was last at minimum, now near magnitude 10. Its normal maximum magnitude is about 6.5. Chi Cygni, 194632, is rapidly increasing to naked eye visibility and should prove a good candidate as a variable suitable for some of the newer observers. Attention is called to the close watch kept on Z Camelopardalis, 081473, by Messrs. Bunting, Meek, and Vorhies; observations on 63 nights out of a possible 87. All observers have been very keen on observing the old stand-by, SS Cygni, 213843, it having been observed on all but three nights between J.D. 26500 and 26569.

Sept. 5, 1931. LEON CAMPBELL, Recording Secretary.

COMET NOTES

By G. VAN BIESBROECK.

In the last issue a brief statement was made concerning NAGATA'S COMET (1931 *b*) the discovery of which had just been announced. This can now be supplemented by the following information. The object was found on July 15 by Masani Nagata, a Japanese fruit grower, living near Brawley in Southern California. With his 3-inch telescope this amateur astronomer was looking for the planet Neptune after sunset when he noticed an unfamiliar nebulous object within the field of view. The region was soon lost near the horizon. But the next evening Nagata picked up the same object, which had moved one degree eastward in the meantime. There was no longer any doubt; this was a comet but, its brightness corresponding to that of a seventh magnitude star, the discoverer hardly believed that others would not have seen it before him and he modestly inquired at the Mt. Wilson Observatory if this was a known object. On the mountain the new object was at once photographed with the 10-inch Cooke telescope and its position determined. From there the news was transmitted to the Central Bureau at Harvard but unfortunately an old, now discarded, form of code was used and this led to considerable confusion. Interpreted literally the

telegram, broadcast on July 18, reported an observation made at 9:00 A.M. Pacific Standard Time, which seemed to indicate that the observer was located at a longitude entirely different from that of Mount Wilson. In the place assigned for the length of the tail a figure 4 meant a tail of that many degrees in extent; for the brightness a figure that might have been interpreted as magniude 3.1 added to the confusion! But it soon was learned that a code no longer used since 1906 was responsible for the misinterpretation. The figure 4 meant an object of the fourth class of visibility, which is an object requiring the use of a small telescope to be seen. Subsequent observations from various places were soon available and since then this comet has been followed continuously. The following orbits have been published:

	Zug & Berman	F. E Seagrave	R. Zug	C. H. Smiley
Perihelion 1931 June	15.14	9.537	11.6459	12.0823
Node to perihelion	324° 58′	317° 17′4	319° 47′2	320° 34′7
Node	191° 8′	192° 18′6	191° 11′3	191° 6′6
Inclination	41° 24′	42° 32′0	42° 26′0	42° 14′5
Perihelion distance	1.080	1.0140	1.0454	1.0520
Dates used	July 18, 20, 22	July 19, 25, 31	July 19, 25 Aug. 6	July 19, 31 Aug. 12

Seagrave's computation led him to an elliptic orbit with an eccentricity of 0.85 corresponding to a period of revolution of 17 years. But the interval of time covered by the observations is too small to warrant such a conclusion. The fourth orbit depending on an interval of 24 days gives already a fair approximation. The most recent observation by the writer shows that the correction to the ephemeris deduced from Smiley's elements was:

Sept. 17 $+6^{s}$ and $0'$

With these same elements I have computed the continuation of the ephemeris for October, showing that the comet is moving across the constellation of Serpens.

EPHEMERIS OF NAGATA'S COMET (1931 *b*).

1931 0^{h} U.T.	α h m s	δ ° ′	Distance—From Sun	Distance—From Earth	Mag.
Oct. 1	14 39 7	+7 6.6	2.02	2.76	10.0
5	48 21	6 52.2	2.06	2.82	10.1
9	14 57 23	38.5	2.11	2.87	10.2
13	15 6 13	25.9	2.16	2.93	10.3
17	14 53	14.2	2.21	2.99	10.4
21	23 20	6 3.7	2.25	3.05	10.5
25	31 38	5 54.5	2.30	3.10	10.6
29	39 44	46.5	2.35	3.16	10.6
Nov. 2	47 41	39.8	2.40	3.22	10.7
6	15 55 29	34.7	2.44	3.27	10.8

The brightness was assumed as $10^{M}.0$ on the first date. Since its discovery the comet has lost steadily in brightness. In the first days it was easily visible in a small telescope in spite of the low altitude and I roughly estimated the magnitude as seventh. By the middle of September the integrated brightness had dropped to $9^{M}.5$ but it was difficult to estimate, since the comet appeared as a diffuse nebula. In the middle of August several exposures with the 24-inch reflector had shown a broad tail extending for about half a degree in position angle 110°. In September it was no longer possible to see the tail. During all of the month of October the comet will set about three hours after the sun for these latitudes but will gradually

lose in brightness. In all probability it will remain in reach of large telescopes in the northern hemisphere through the conjunction with the sun in December.

It is a little surprising that the comet had not been picked up last June by southern observers. At the time of perihelion the angular separation from the sun was about 70° and the comet must have been visible then with the naked eye in the evening sky.

COMET 1931 *c* (RYVES). In August another new comet was found, this being a morning object, quite bright but visible only for a short time before dawn. It was discovered by P. Ryves, well-known variable star observer in Zaragossa (Spain), who first saw it on August 10. It was then situated within a couple of degrees from the variable U Geminorum and very likely Mr. Ryves noticed the comet while looking up this variable, to which he has for many years paid a great deal of attention. He secured only rough observations:

1931	α h m s	δ ° ′	Mag.
Aug. 10.146	7 42 6	+23 48	5
12.167	7 52 0	23 19	
13.16	7 55 18	23 8	

Confirmation of the discovery was asked here from the Central Bureau at Copenhagen on August 13. The next morning the comet was easily located before sunrise and its position determined from a plate taken with the 24-inch reflector.

1931 Aug. 14.39519 $\alpha = 8^h\,4^m\,32^s.52$ $\delta = 22°\,45'\,46''.0$ Mag. 4

It was seen here again on subsequent mornings but the comet was moving rapidly toward the sun and no suitable comparison stars could be found either on photographs or visually. Other observers especially at Mt. Hamilton were however more successful. The following observations have become available:

1931	α h m s	δ ° ′ ″	Observer
Aug. 15.5202	8 11 50.0	22 24 49	C. Bower, Lick Observatory
16.5234	8 18 56.6	22 2 30	C. Bower, Lick Observatory
17.5228	8 26 43.2	21 36 23	C. Bower, Lick Observatory
17.80192	8 29 3.2	21 28 52	K. Nakamura, Kyoto Obs.
19.51870	8 44 48.59	20 27 40.7	C. Smith, Lick Observatory
19.82046	8 47 43.2	20 16	K. Nakamura, Kyoto Obs.

Three orbits have been computed so far:

	L. E. Cunningham	Bower and Miss Miller	Shibata and Oieta
Time of perihelion 1931 U.T.	Aug. 25.90	Aug. 25.9147	Aug. 25.85
Node to Perihelion	168° 26′	167° 36′ 51″	169°.4
Node	101 04	100 55 53	97.1
Inclination	169 11	169 12 26	167.5
Perihelion distance	0.073	0.075185	0.056
Dates used (Aug.)	14, 15, 17	15, 16, 17	14, 17, 19

The last elements as well as the two Kyoto observations given above were received by mail from Mr. K. Nakamura, who reports to have seen the comet again on August 20.8 but no measurements could be made. All the positions were secured under difficult conditions; for instance on August 19.5 (Lick) the altitude of the comet was only 5°.3 above the horizon. The discoverer estimated the brightness from 5^M on August 10 to 2^M on August 17. On August 14 the writer could see the comet steadily with the naked eye although the sky was already strongly

illuminated by the dawn. There was a sharp stellar nucleus surrounded by a bright coma about 30″ in diameter out of which emanated a broad tail faintly visible over more than half a degree, in position angle 290°. Mr. Nakamura reports on August 17 a straight tail two degrees long and besides a curved branch on either side.

Although the comet must have gained in brightness after August 20, since its perihelion distance became quite small it was lost in the vicinity of the sun and nobody seems to have succeeded in picking it up at or after its closest approach to the sun (August 25.9). The position at the present time is of course uncertain and while the comet may be seen again in the morning sky around October 1 it will have lost so much in brightness that its recovery will be difficult. Cunningham's orbit gives the following predicted position, showing that the comet is located in Leo:

1931	α h m s	δ ° ′
Sept. 24	10 48 53	+3 24
28	49 45	3 10
Oct. 2	50 32	2 57

On p. 404 we reported the recovery of ENCKE'S PERIODIC COMET (1931 *a*) at Cordoba (Argentina) on June 21. Already a week earlier the comet had been recorded on plates taken at the Union Observatory, Johannesburg, by H. E. Wood, who called the magnitude 7th on June 14. The comet was followed there in its rapid decrease in brightness during June and July.

BEYER'S COMET (1930 *b*) was last observed here photographically August 12-13. It showed a tiny nucleus surrounded by a faint nebulosity, the total brightness not being greater than that of a star of magnitude 17. It is now too faint for further observations.

The possibility of the recovery of NEUJMIN'S PERIODIC COMET (1913 III) this year becomes very doubtful. It was not found on a good pair of plates taken here by Mr. Recht in August with the 10-inch Bruce camera. The plates show stars down to the 15th magnitude and widely cover what is believed to be the region of uncertitude of the position. It is hoped that other observers may be more successful.

Two other periodic comets, namely COMET SCHORR (1918 III) and COMET WOLF (1924 IV), are expected to return to perihelion in the first half of 1932. According to the ephemerides given in the *Handbook* (1931) *of the British Astronomical Association* both these objects might be looked for this fall but their positions are subject to considerable doubt and both are expected to be extremely faint.

Williams Bay, Wisconsin, Sept. 23, 1931.

COMET NEUJMIN (1913 III).

A telegram, as follows, was received at Northfield after the above notes were already in type:

Moving object probably Comet Neujmin (1913 III) observed by Nicholson September 17.5125, $\alpha = 4^h\,43^m\,49^s$, $\delta = +38°\,29'$, magnitude 15, motion east 40″ north 9′. No nebulosity. HARLOW SHAPLEY.

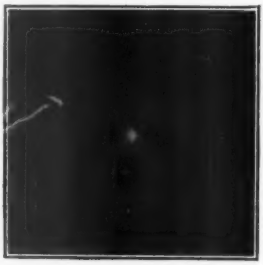
Cambridge, Massachusetts, Sept. 25, 1931.

Observations of Nagata's Comet with the 100-inch Telescope

Nagata's Comet was photographed in the twilight with the 100-inch Hooker telescope on the evenings of July 20, July 21, and August 19 by Duncan, with exposures of 5, 15, and 15 minutes, respectively. In the July observations no allowance was made for the comet's proper motion, and so the comet appears on each plate as a trail, while the star images are round. On August 19, the computed proper motion was set off by moving the plate 0".5 every 15 seconds, with the result that the comet's image was stationary while the stars were recorded as trails. The following position was obtained from this photograph.

G.C.T.	α (1931.0)	δ (1931.0)
Aug. $20^d.1615$	$12^h\,44^m\,54^s.02$	$+9°\,48'\,21''.6$

The July plates, despite the trailing of the image, exhibit a bright stellar nucleus, a coma, and a bifurcated tail about 6′ long. The August plate, which is reproduced herewith, shows no trace of a tail but does show a coma, which is extended slightly in each direction at right angles to the line joining the comet and the sun. On the original negative there appear to be two nuclei, about 5″



Comet Nagata.

apart, directly in line with the sun; but without a confirmatory plate it is impossible to be sure that both nuclei are real.

The wide-spread report that, when observed at the Mount Wilson Observatory shortly after its discovery, Nagata's Comet had a tail 4° long arose from the inadvertent use of an obsolete blank code form for a telegraphic message to the Harvard College Observatory. The appearance of the comet on July 17, 18, 19, as photographed with the 10-inch by Moore and Ross was not essentially different from its appearance on the photographs with the 100-inch telescopes.

Observed visually with a low-power eyepiece at the Newtonian focus of the Hooker telescope, Nagata's Comet, on all three nights, appeared to be of a yellow color, in striking contrast to Ryves' Comet, which, seen with the 6-inch reflector in the dawn of August 20, was greenish-blue.

The position of Ryves' Comet as determined from the circle readings of the 6-inch refractor was as follows:

G.C.T.	α	δ	Mag.
Aug. $19^d.514$	$8^h\,45^m.2$	$+20°\,36'$	5

John C. Duncan and Seth B. Nicholson.
Carnegie Institution of Washington, Mt. Wilson Observatory, August, 1931.

METEOR NOTES

By CHARLES P. OLIVIER.

The Perseid shower of last month came when the moon did not interfere, and hence conditions were excellent for observers with clear skies. The usual publicity campaign through journals, newspapers, and radio warned the public that their aid would be appreciated. Unfortunately heavy clouds, at the time of maximum, covered most of the New England and Atlantic states, though from Virginia southward there were a few clear spots. However, Canada, the Gulf, Central, and Western states were favored with clear weather, and the response from these sections was very gratifying.

In the accompanying table will be found the condensed data reported by persons not members of the A.M.S. though several have since joined. In all, 143 names appear here; a good many others whose reports are too fragmentary to be of value are omitted. Also about 40 other full and valuable reports are held up, as this table is abnormally long. The table is in our usual form, with a few modifications. The first column gives a reference number which will be used in later discussion so that the full data will not have to be reprinted. The factor column refers only to the clearness of the night, not to other modifying conditions. In the notes, when the time is entered it was specifically given by the observer.

Very many observers sent in excellent tabular data giving half-hour counts. A few even gave 5-minute counts. Many attempted to describe in detail the brighter meteors, others made maps and plotted them. As usual, many did not fully understand just what was wanted, but the average of the reports is very good. We have also many reports from our regular A.M.S. members dealing with the Perseids, but these must wait until a later issue. It is only right to give our volunteer helpers the slight precedence of earlier publication, though, as said, about 40 of these have to wait also.

Not until all of these reports appear will the writer undertake an analysis of the results. It is sufficient to say here that for an observer with an unobstructed view, clear sky, and good eyesight, the rate was certainly over one per minute after midnight on both August 11 and 12. A closer study of the results will be needed to determine the hour of maximum. It will be noticeable that certain observers saw as low as one tenth the number counted by others. In most cases this can readily be explained by poor atmospheric conditions, observing in a city, observing from a window, poor eyesight, etc. But the various rates derived show the importance of having many observers in widely scattered stations. The main difficulty to be met with in a study of the table will be the interpretation of the counts made by several observers, as our unit is perforce the hourly rate for one person. In this connection, it will be noted that a large proportion of the 143 reports were made by two or more observers. To save space only one name has been entered here.

We hope that this growing interest in meteors will lead many to try again for the Leonids in November, as there is reason to hope for a good shower on one of the three nights, November 15-16, 16-17, or 17-18.

Grateful acknowledgement is hereby made to all the sources of publicity through which the public was reached. Also in the name of the American Meteor

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Aug. $20^d.1615$	$12^h\,44^m\,54^s.02$	$+9°\,48'\,21''.6$

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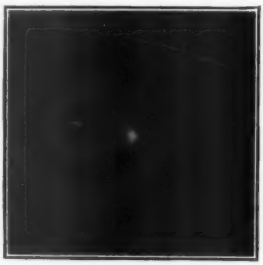

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By CHARLES P. OLIVIER.

The Perseid shower of last month came when the moon did not interfere, and hence conditions were excellent for observers with clear skies. The usual publicity campaign through journals, newspapers, and radio warned the public that their aid would be appreciated. Unfortunately heavy clouds, at the time of maximum, covered most of the New England and Atlantic states, though from Virginia southward there were a few clear spots. However, Canada, the Gulf, Central, and Western states were favored with clear weather, and the response from these sections was very gratifying.

In the accompanying table will be found the condensed data reported by persons not members of the A.M.S. though several have since joined. In all, 143 names appear here; a good many others whose reports are too fragmentary to be of value are omitted. Also about 40 other full and valuable reports are held up, as this table is abnormally long. The table is in our usual form, with a few modifications. The first column gives a reference number which will be used in later discussion so that the full data will not have to be reprinted. The factor column refers only to the clearness of the night, not to other modifying conditions. In the notes, when the time is entered it was specifically given by the observer.

Very many observers sent in excellent tabular data giving half-hour counts. A few even gave 5-minute counts. Many attempted to describe in detail the brighter meteors, others made maps and plotted them. As usual, many did not fully understand just what was wanted, but the average of the reports is very good. We have also many reports from our regular A.M.S. members dealing with the Perseids, but these must wait until a later issue. It is only right to give our volunteer helpers the slight precedence of earlier publication, though, as said, about 40 of these have to wait also.

Not until all of these reports appear will the writer undertake an analysis of the results. It is sufficient to say here that for an observer with an unobstructed view, clear sky, and good eyesight, the rate was certainly over one per minute after midnight on both August 11 and 12. A closer study of the results will be needed to determine the hour of maximum. It will be noticeable that certain observers saw as low as one tenth the number counted by others. In most cases this can readily be explained by poor atmospheric conditions, observing in a city, observing from a window, poor eyesight, etc. But the various rates derived show the importance of having many observers in widely scattered stations. The main difficulty to be met with in a study of the table will be the interpretation of the counts made by several observers, as our unit is perforce the hourly rate for one person. In this connection, it will be noted that a large proportion of the 143 reports were made by two or more observers. To save space only one name has been entered here.

We hope that this growing interest in meteors will lead many to try again for the Leonids in November, as there is reason to hope for a good shower on one of the three nights, November 15-16, 16-17, or 17-18.

Grateful acknowledgement is hereby made to all the sources of publicity through which the public was reached. Also in the name of the American Meteor

No.	Name and Station	Date	Began	Ended	Ttl.	Meteors	Fac.
3	Coffin, A. A., Mobile, Ala.	11	12:30	13:00	30	18	...
8	Reavis, G., Ft. Smith, Ark.	8	9:30	11:30	90	17	...
		10				7	...
13	Stothard, W., Vancouver, B. C.	11	12:00	13:00	60	39	...
62	Livingstone, A. G., Port Alberni, B.C.	12	9:30	10:30	60	19	0.8
72	Ford, G. R. M., Kelomna, B. C.	12	9:45	10:45	60	34	...
17	Burleson, W. D., Gridley, Calif.	10	8:30	12:	180	25	0.6
63	Brown, E. A., Merced, Calif.	12	11:50	12:50	60	58	0.9
65	Danz, Miss C., San Francisco, Calif.	12	11:15		10	6	0.7
143	Bonestall, Mrs. C. C., Monolith, Calif.						
144	Hill, Miss Mary J., Piedmont, Calif.	12	15:00	16:00	60	16	0.3
89	Miller, Mrs. F. W., Yuma, Colo.	11	early		30	25	1.0
140	Harrison, B., Loma, Colo.	11	8:50	10:30	100	78	1.0
		12	8:50	10:30	100	114	...
147	Blunk, C. M., Crescent, Colo.	12	9:10	9:48	38	52	...
43	Davies, H. N., Miami, Florida	11	11:15	12:00	45	10	...
52	Hoyt, C. A., Jacksonville, Florida	12	11:00	14:00	180	189	...
59	Greenberg, G., W. Palm Beach, Fla.	11	12:30	16:30	240	362	0.9
137	Archibald-Huckins, K. W., Jacksonville, Fla.	11	12:00	13:00	60	58	...
130	Bentley, L. W., Sandersville, Georgia	12	10:40	11:10	30	11	...
162	Sikes, Miss G. E., Augusta, Georgia	12	10:00	11:30	90	16	1.0
145	Forney, Mrs. B. B., Augusta, Georgia	11	9:30	12:25	175	25	0.5
		12	9:00	11:20	140	50	0.7
146	Nix, O. A., Carrollton, Georgia	11	11:15	16:00	..	21	1.0
		12	11:15	16:00	..	25	1.0
37	Craig, Miss P. E., Decatur, Illinois	11	7:45	9:30	105	32	...
42	Sander, C. L., Chicago, Illinois	11	11:00	14:00	180	37	...
48	Bennett, C. A., Carmi, Illinois	11	14:00	14:30	30	17	...
54	Bassler, C., Nashville, Illinois	11	13:00	13:30	30	17	...
85	Davis, Miss D. N., E. St. Louis, Illinois	11	13:35	15:00	60	53	...
		12	15:10	16:10	60	36	...
112	Denson, P. A., Stonefort, Illinois	11	10:39	15:55	316	117	1.0
116	Weston, B. H., Wood River, Illinois	11	9:40	14:10	270	187	...
		12	12:50	15:50	180	163	...
23	Hamberger, A., Nappanee, Indiana	11	13:30	14:00	30	32	1.0
99	Smith, Miss M., Greencastle, Indiana	11	12:00	12:30	30	43	1.0
		12	12:00	12:30	30	40	1.0
56	Kirby, L. M., New Market, Iowa	11	13:16	14:16	60	139	1.0
125	Ries, G. W., Pella, Iowa	11	10:00	12:30	75	46	1.0
134	Jewell, Dr. T. M., Coon Rapids, Iowa	11	10:00	13:30	210	152	...
138	Bosworth, R. D., Moville, Iowa	11	11:20	13:00	100	108	1.0
4	Barth, J. S., Atkinson, Kansas	11	11:40	12:44	64	29	...
40	Ronnsavell, R. A., Humboldt, Kansas	11	12:41	14:00	..	29	...
102	Vollmer, Major A., Ft. Leavenworth, Kansas	11			25	10	...
44	Pennell, R. E., Waverley Hills, Kentucky	11	9:20	13:50	..	67	0.5
45	Bell, G. C., Glasgow, Kentucky	11	12:20	13:15	55	123	...
57	Brashear, Miss K., Bowling Green, Kentucky	11	10:00	13:00	180	80	...
60	Wright, W., Franklin, Kentucky	11	14:10	15:10	60	84	...
61	Slate, G. E., Franklin, Kentucky	11	14:10	15:10	60	32	...
74	Wakefield, E. M., Glasgow, Kentucky	11	13:	15:	120	23	...
139	Richards, Mrs. S. T., Delvinta, Kentucky	11				27	0.5
148	Flanagan, P., New Orleans, Louisiana	11	11:40	13:40	120	64	...
		12	12:00	13:30	90	37	...
154	Ives, R. L., Sonora, Mexico	11	8:	12:	..	..	...
11	Weller, C. A., Flint, Michigan	11	10:00	12:40	?	82	0.7
25	Boyd, Mrs. E. C., Fond du Lac, Michigan	11	12:00	12:30	30	16	...

Fac.	No.	Name and Station	Date	Began	Ended	Ttl.	Meteors	Fac.
...	26	Whinfield, Mrs. C. E., Fond du Lac, Michigan	11	12:00	12:30	30	15	...
...	28	Braden, Miss A., Flint, Michigan	11	10:00	11:15	75	87	...
...	29	Dean, Mrs. R. M., Pellston, Michigan	11	11:00	12:45	105	156	1.0
...	38	Reynolds, E., Kalamazoo, Michigan	11	11:45	12:25	40	53	...
0.8	46	Oberblom, C. O., Ironwood, Michigan	11	10:30	12:00	90	46	1.0
...	64	Fischer, M., Sagetown, Michigan	11	11:40	14:00	140	91	1.0
0.6			12	12:20	12:40	20	7	0.5
0.9	68	Reid, Mrs. A., Muskegon, Michigan	12	13:30	14:00	30	15	...
0.7	69	Tomasch, T., Jackson, Michigan	11	8:50	11:00	130	23	1.0
			12	8:55	12:00	185	50	1.0
0.3			13				4	1.0
1.0			14				4	1.0
1.0	79	Evans, Wm., Kalamazoo, Michigan	11	8:58	10:15	77	25	1.0
...			12	9:54	10:58	64	40	1.0
...	91	Yokkota, E., Wakefield, Michigan	11	12:00	12:30	30	34	...
...	115	Bottkol, J. A., Menominee, Michigan	12	10:30	12:10	100	41	...
...	120	Birge, R. N., Hissel, Michigan	11	9:30	10:30	60	49	...
...	121	Ray, D. J., Bay City, Michigan	11	11:15	12:10	55	7	...
0.9	122	Ray, Mrs. C. P., Bay City, Michigan	12	11:30	12:30	60	3	...
...	123	Landrath, H., Sheboygan, Michigan	11?				50	...
...	124	Sheldon, Mrs. M., Lexington, Michigan	11	9:15		120	60	...
1.0	136	Iehl, Miss B. L., Allegan, Michigan	11	12:00	15:30	210	234	...
0.5			12	10:00	14:30	270	130	...
0.7	149	Powell, H. K., Adrian, Michigan	12	10:00	10:30	20	4	0.7
1.0	2	Campkin, B. K., Laurel, Mississippi	9	8:	10:			0.7
1.0	76	Smith, Miss D. W., Tupolo, Mississippi	11?				16	...
...	9	Lustman, Miss L. R., St. Paul, Minnesota	11	11:00	12:30	90	48	0.7
...	19	Smith, R. G. E., Minneapolis, Minnesota	11	12:00	12:30	30	10	...
...	39	Hansen, L. E., Little Falls, Minnesota	11?				43	...
...	95	Meeker, Miss May S., Minneapolis, Minn.	11	11:55		30	7	1.0
...	114	McIver, W. R., Minneapolis, Minnesota	11	11:20	12:06	46	17	1.0
1.0	150	Reim, V. P., New Ulm, Minnesota	11	11:00	12:15	75	72	...
...	7	Price, P. A., Winona, Missouri	7	9:00	9:15	15	6	...
...	27	Bass, E., Overland, Missouri	11	11:00	13:15	155	92	...
1.0	67	Sidwell, J. D., Cape Girardeau, Missouri	11	11:05	12:05	60	59	...
1.0	81	Hall, L. M., St. Louis, Missouri	11				50	...
1.0	82	Steinheil, F., St. Louis, Missouri	10	12:00	12:30	30	12	...
1.0	103	Wood, F. M., E. Prairie, Missouri	11				125	...
1.0	104	Adams, E. L., Joplin, Missouri	11	12:10	14:51	161	26	...
...			12	11:50	13:17	87	8	...
1.0	106	*McGlothlin, Miss F., Monroe City, Missouri	11	12:35	13:45	70	72	0.8
...	108	Barry, Prof. W. G., St. Louis, Missouri	11	12:01	13:01	30	18	...
...	117	Bowman, E. F., Kansas City, Missouri	11	11:00	16:00	300	154	...
...			12	11:15	16:30	315	148	...
0.5	119	Mickel, N., St. Paul, Missouri	11	10:00	12:15			...
...	151	Ereitenbaugh, Miss D., Lee's Summit, Mo.	11	11:30	12:45	75	12	...
...	152	du Uryl, Miss V., Jefferson City, Missouri	11	12:15	13:00	45	48	...
...	161	Bicknell, J. S., Columbia, Missouri	10	13:30	15:00	90	47	...
...	10	Swingle, Mrs. C. L., Roundup, Montana	11	12:20	12:50	30	32	0.7
0.5	71	Swain, Mrs. E. A., Bascum, Montana	11	10:00	12:00	120	40	0.9
	96	Jones, Ross, Bynam, Montana	11	12:00	13:00	60	44	0.8
...	107	Royal, P. P., Drummond, Montana	11	12:00	14:00	120	51	1.0
...	133	Watt, M. K., Helena, Montana	11	11:15	12:00	45	16	1.0
...			12				26	...
0.7	18	DeLand, L. H., St. Edwards, Nebraska	11	9:30	14:45	315	250	0.9
...	53	Long, A. E., Omaha, Nebraska	11	9:30	11:00	90	26	0.6

No.	Name and Station	Date	Began	Ended	Ttl.	Meteors	Fac.
32	Kunkle, Mrs. G. C. T., Margate Park, N.J.	12	12:55	13:35	40	7	0.2
			14:		5	13	1.0
14	Schmanke, F., Irondequoit Bay, N. Y.	11	12:23	14:10	107	18	0.5
50	Morgan, J. I., Farmville, North Carolina	10	10:45	11:00	15	few	...
		12	10:30	12:00	90	10	...
		12	12:15	13:15	60	50	0.8
36	Durst, C. E., Dayton, Ohio	10	9:00	10:03	63	9	...
6	Fortner, Miss F. F., Wynona, Oklahoma	11	12:15	13:15	60	54	1.0
12	Kendale, G. D., Chickasha, Oklahoma	12	10:30	12:10	100	11	...
20	Challman, R. T., Enid, Oklahoma	11	11:59	12:40	41	52	1.0
73	Kniffen, C., Sulphur, Oklahoma	12	10:00	11:00	60	25	...
			15:30	16:30	60	26	...
105	Fitch, Miss N., Roff, Oklahoma	11	10:00	12:30	150	105	1.0
142	Eldridge, R. L., Cardin, Oklahoma		8:50	13:00	212	95	1.0
16	Harris, Mrs. M. G., Sarnice, Ontario	11	10:30	11:30	60	10	0.5
			12:00	12:30	30	8	0.3
21	Wolland, Rev. E. J., Beamsville, Ontario	11	12:00	13:30	90	21	0.7
22	Hall, L. J., Sarnia, Ontario	11	10:00	11:00	60	41	1.0
		12	12:00	13:22	82	57	1.0
24	Jordison, T., Hybla, Ontario	11			60	74	...
35	McPherson, Miss M. L., Stratford, Ontario	11	12:00	14:00	120	12	0.6
97	Caughey, J. E., Wallaceburg, Ontario	11	9:	13:30	240	16	...
101	Knof, Miss M., Miners Bay, Ontario	11	11:30	12:30	60	40	0.9
133	McAlpine, Mrs, H. A., Walkers, Ontario	11	11:40	11:55	15	8	0.7
34	Grout, H., Pomeroy, Pennsylvania	10	12:00	14:00	120	24	...
		11	13:			6	0.3
77	Kraus, Miss B., Pittsburgh, Pennsylvania	13	10:00	11:30	90	17	...
		14	10:30	12:00	90	21	...
15	Swift, L., Palestine, Texas	11	8:00	12:05	245	139	...
109	Clemmer, W. C., Hamilton, Texas	11	10:00	13:00	180	183	1.0
110	Scott, R. L., DeLeon, Texas	11	14:00	14:15	15	14	1.0
131	Pilcher, Dr. J. F., Galveston, Texas	11	12:30	13:30	60	78	0.8
141	Wakefield, J. I., Greenville, Texas	11	10:00	13:15	195	20	...
132	Rinehart, W. M., Centerville, Tennessee	11	11:45	14:15	150	326	1.0
31	Grotophont, C., Spring Grove, Virginia	12	11:15	14:30	195	103	...
30	Bailey, F., Gassaway, West Virginia	11	12:30	16:00	210	250	0.9
111	Speron, Miss E., Martinsburg, West Virginia	13					
80	Smith, Mrs. G. A., Ellensburg, Washington	12	11:40	12:40	60	75	...
84	Knox, S., Colfax, Washington	11	9:50	10:00	10	8	...
118	Schlnenz, Mrs. W. F., Waterville, Wash.	11	9:50	11:30		21	...
126	Meadows, D., Spokane, Washington	11	14:25	14:35	10	7	...
156	Wilson, E. D., Everett, Washington	12			180	76	0.5
1	Houser, A., Vesper, Wisconsin	11	11:30	15:30	240	34	...
41	Reich, E. R., Marshfield, Wisconsin	11	11:40	? 13:30	90	87	...
47	Showinski, E. C., Kenosha, Wisconsin	11	11:42	12:42	60	104	...
49	Hyatt, C., Sheboygan, Wisconsin	12	8:40	9:20	40	19	...
83	Bohn, Mrs. F., Shell Lake, Wisconsin	11	12:00	13:00	60	110	...
90	Putnam, Mrs. R. M., Oconto Falls, Wis.	11	10:15	12:15	120	39	...
		12	9:			75	...
98	Quinn, R. J., Rice Lake, Wisconsin	11	11:30	14:30	180	286	1.0
127	Klatt, Miss M. E., Elmwood, Wisconsin	11	9:30	13:00	210	201	1.0
135	Luckinbill, Miss R., Superior, Wisconsin	11	10:05	11:30	85	30	1.0
157	Pederson, Miss L., Lake Nebagamon, Wis.	11	9:00	13:00	240	106	1.0
158	Anderson, A. G., Eau Claire, Wisconsin	11	11:30	12:30	60	54	1.0

No.	Name and Station	Date	Began	Ended	Ttl.	Meteors	Fac.
66	Keays, W. P., Buffalo, Wyoming	10	12:30	14:00		0	...
		11	9:00	10:00		8	...
		12	10:00	?		0	...
70	Wallerins, A., Laramie, Wyoming	11	12:00	12:30	30	23	1.0
113	Jacobucci, J. F., Green River, Wyoming	7				5	...
		11	11:30	11:55	25	7	...
		12	9:45	10:55	70	52	...

The following notes are associated with the preceding table as indicated by the reference numbers.

No.	Notes
3	Details.
8	Casuals.
72	Eight W.
17	Nineteen Perseids.
143	Great number, Aug. 8-12.
144	In city.
89	Two observers.
140a.	Three observers.
140b.	Two observers.
147	Six observers.
43	Plotted
59	Three observers.
130	Perseids.
162	Only brilliant ones counted.
145a.	Three observers.
145b.	Three observers.
146	Plotted; no counts.
37	Observer ten years old.
48	Plotted.
112	Full records made of each.
23	From west window.
99	Three observers watching different directions.
56	Duplicate count in part.
125	"In city, no obstructions"
138	Two observers, 90 Perseids.
4	Two observers.
40	Intermittent watch.
102	Five observers.
44	From hospital bed.
57	Five observers.
60	To Northeast.
61	C.S.T.; To Southwest.
74	23 large, very many small.
154	"Many."
25	Plotted
26	Plotted.
28	3 observers; only those counted which were seen by at least two observers.
29	E.S.T.; Four observers.
38	Two observers; twelve very bright meteors.
91	E.S.T.
120	E.S.T.
123	±, rate 50 per half hour.
124	±.
136	C.S.T., two observers watching different parts of sky.
149	Plotted.
2	Large numbers, ten bright.
9	In city.
19	In city?
39	±.
95	Only bright ones noted.
114	In city; full records of each.
150	Two observers.
27	Notes also; three casuals.
67	C.S.T.
81	? observers (group).
103	Mostly before 12 hours.
104	Notes on each.
106	Two observers; trees.
117	Notes on many.
119	Several.
151	All large, many small.
152	All fairly bright, faint not counted.
10	"and family" that is, several observers.
107	Two observers.
18	A "few" observers, all parts of sky.
14	Each described.
50	Very brilliant.
86	Each fully described.
12	Plotted; 30± more seen.
105	Northeast, 13 by others.
16a.	Trees interfered.
16b.	Trees interfered; clouds.
22a.	17 very brilliant; 3 observers.
22b.	7 very brilliant; 3 observers.
101	E.S.T., 3 observers.
133	Others seen August 12.
34	Two observers.
15	Two observers.
109	Twenty-one bright.
131	Two observers; Nine seen earlier.
141	All plotted.
132	C.S.T.
30	Two observers; no duplicates.
111	Several, one fireball.
80	Five observers, 56 by one observer.
84	Two observers.
118	Intermittent watch; notes.
156	Three observers.

No.	Notes	No.	Notes
1	Observer 85 years old.	157	From north window.
47	Twenty-one bright.	158	Some details given.
83	Two observers.	66	Why were none seen?
90	Three observers; some details; 25 seen August 13.	70	All plotted, 21 Perseids.
98	Three observers.	113a.	Casuals.
		113c.	Two observers.

Society the writer expresses grateful thanks and appreciation to all these persons, who, often at considerable trouble to themselves, observed and reported the August Perseids. Such persons may be sure that their efforts have made a real contribution to our knowledge of this most interesting stream, and thus to meteoric astronomy in general.

Flower Observatory, Upper Darby, Pennsylvania, 1931 September 21.

Fireballs Reported to the University of Iowa

This list follows that published in the April issue of POPULAR ASTRONOMY. Only meteors reported from two or more communities are included, a few reported by more than one observer from the same community being omitted. The times are 90th meridian, and noon to noon reckoning.

April 8, 7:40. A bright meteor was reported by three residents of Iowa City, and by two residents of Ottumwa, Iowa. It passed from southeast to northwest, was compared to a giant skyrocket, and left a trail.

June 12, 8:45. A meteor about twice the brilliancy of Venus was observed from Keokuk, in southeastern Iowa, by Bemrose Boyd, and from Carson, in western Iowa, by Robert N. Wolfe. Both observers reported it blue white, and Mr. Boyd reported that tongues of flame were shooting from the sides giving it the appearance of a blazing mass. An observer from Creston sent a sketch showing the fire shooting from the head of the meteor.

August 4, 7:55. The most spectacular meteor of the year causing detonations heard from points fifty miles apart. At points two hundred to three hundred miles from the actual point of bursting, reporters were tracing stories of an airplane which had "gone down in flames." Reports are at hand from all points of Iowa and Minnesota. Mr. Charles D. Reed of the U. S. Weather Bureau at Des Moines sent a large folder of observations. Mr. Arnold Rosenstein, of the Department of Astronomy of the University of Minnesota, sent several reports and an approximate calculation of the path through the atmosphere. His result is that the meteor was eighty miles high near Faribault, and fifteen miles up over a point between Sleepy Eye and Redwood Falls when it burst and disappeared. He is not satisfied with his results and we have not had an opportunity to discuss the much larger amount of material now available.

September 10, 6:42. A meteor attracted considerable attention in eastern Iowa, southern Wisconsin, northern Illinois, and northern Indiana. Reports were forwarded to us by Professor Frost of the Yerkes Observatory, by Dr. Fox of the Adler Planetarium, by Father Theobald of Columbia College, and others. This meteor was east of Chicago and north of South Bend, Indiana, a territory where, because of the lack of interest of Chicago newspapers, we have never been able to follow meteors up satisfactorily. We have for some time been able to cover Illinois as far north as Galesburg, but even with the assistance of the Adler Planetarium it is difficult to get much from north of that city. We hope that additional interest can be aroused.

C. C. WYLIE.

University of Iowa, September 24, 1931.

NOTES FROM AMATEURS

Amateur Telescope Makers of Chicago

The society of Amateur Telescope Makers of Chicago met for the first time at the Adler Planetarium on September 13, 1931, at 2:00 P.M. Dr. Fox addressed the meeting and assured us of the co-operation of the Planetarium in our work. Through his kindness the club will hold its future meetings there. Dr. Fox then introduced Dr. D. W. Morehouse of Drake University. Dr. Morehouse complimented our society and related a few incidents of his experiences at Drake. Dr. Morehouse is the discoverer of Morehouse's Comet.

The attendance numbered twenty-three and quite a few mirrors were in evidence. Mr. Weaver and his 12-inch pyrex were there. President McCord had with him his 5½-inch mirror also of pyrex. Mr. and Mrs. Buttles displayed a 4-inch and a 6-inch, both Cassegrainian. Mr. Broussard and his 8-inch disk were also much in evidence. The most outstanding contribution to the month's work was a beautifully executed 5½-inch portable reflector by Mr. Alfred Klapperich. Mr. Olson, Mr. Klapperich, and Mr. Dennis of the society will spend a week in northern Illinois making general observations and plotting meteors. They will take with them the 5½-inch portable and a 1⅞-inch refractor with sun-attachment.

The club is planning to purchase a small observatory for which Mr. Eason of Georgia will donate two 14½-inch mirrors by means of which, it is hoped, a permanent record of its work may be placed before the public.

For the benefit of new members, short talks were given illustrating and explaining the art of telescope-making.

Three grinding machines and two South Bend lathes have been added to our list of apparatus totaling nearly one thousand dollars more.

One of the big developments was the introduction of an honor-point system for achievement. Information concerning the club may be had by writing Mr. A. J. Klapperich, 412 Central Avenue, Wilmette, Illinois.

WALTER L. DENNIS.

A New Mounting and Housing for a Telescope

Dr. H. Page Bailey, amateur telescope-maker of Riverside, California, has devised a very practical modified English mounting. The essential improvement is a split ring at the north end of the double-yoke whose line of centers parallels the earth's polar axis. This split ring, whose missing section is compensated for by extended counter balances, rides upon two ball-bearing rollers. The casting that carries these rollers is adjustable for tilting so as to reciprocate for any raising or lowering of the south end of the yoke in aligning on polar axis.

The three-point suspension of the yoke provides rigidity and balance in any position of the telescope tube. The split ring has a wide enough opening to accommodate the telescope for observation of the polar region and even an area considerably below the pole. This mounting thus overcomes disadvantages of the German, fork, and English types. Unlike the German mounting it is not necessary to reverse the telescope in following a star across the meridian. The inequalities of sag inherent in a fork mounting are replaced by uniformity of sag in all directions so that the tube remains always parallel to its own axis. The stability of the English type is maintained with the addition of accessibility to the polar stars.

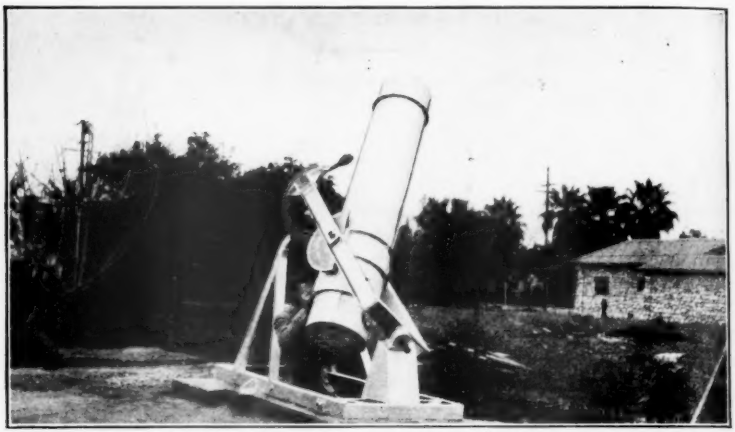

FIGURE 1.
Bailey Telescope Mounting.

The telescope tube, whose center of gravity is kept near the lower end by a heavy mirror-cell, is supported by two trunnions in the yoke. A Cassegrainian

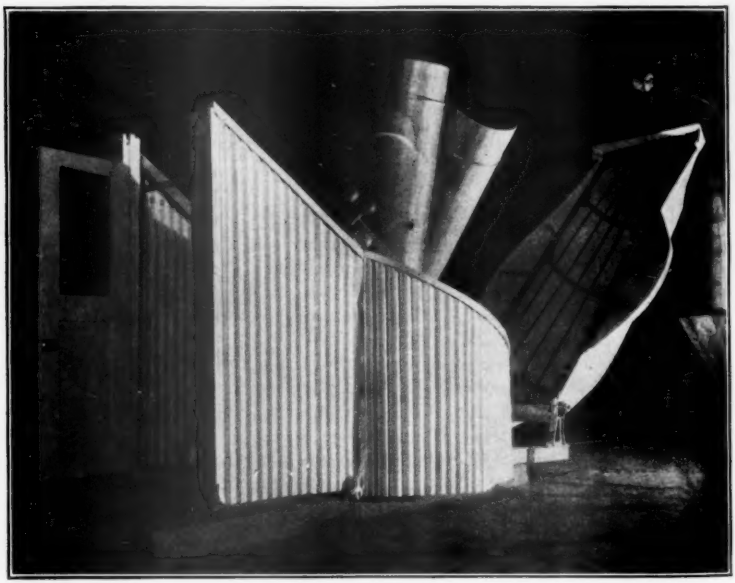

FIGURE 2.
Bailey Telescope Housing Open, Showing Telescope in Three Positions.

arrangement of optical parts permits observation comfortably in all positions since the eye-piece travels in the arc of a small circle.

The south end of the yoke rests against a frictionless self-aligning ball-bearing in the south pier. The worm-gear of the driving clock slides as a friction plate against a shoulder of a collar fixed to the yoke's southern extension. Spring ten-

FIGURE 3.
Bailey Telescope Housing Closed.

sion regulates the amount of friction so that the telescope may be pointed in any direction whereupon the clock (contained in the south pier) picks up the following of the star.

A 24-inch mounting is now being constructed by Dr. Bailey for the observatory of San Bernardino Junior College. The north and south piers are hollow castings to rest upon concrete foundations. The tube is a skeleton framework of chrome molybdenum tubing welded by the "airplane process." Before the order was placed with Dr. Bailey, his private 15-inch instrument was inspected by Dr. John A. Anderson and Professor Russell W. Porter of Mount Wilson and Cali-

fornia Technology Astrophysical Observatory in company with the astronomer of the local college. It was Dr. Anderson's opinion that this mounting "would very greatly enhance the value of the telescope both to the college and to the community."

The simple and inexpensive housing Dr. Bailey employs also deserves attention. It avoids the cost and complexity of a revolving dome. Such a mounting and housing should enable many amateurs and colleges to possess finer instruments at a small fraction of the ordinary outlay.

July 11, 1931. FRANK B. LINDSAY.

ZODIACAL LIGHT NOTES

By W. E. GLANVILLE.

In striking contrast to last summer with its clear nights, the night sky this summer has been overcast almost continuously at this station.

Since his last report the writer made observations on the following dates: August 26, 27, 31; September 3, 11, 12.

MORNING ZODIACAL LIGHT.—On August 26 at 3:40 A.M. the Zodiacal Light was observed south of Castor and Pollux, thence to the horizon just beyond Cancer. On account of scattered clouds the observation was not satisfactory but it was noted that the Light is now sloping upward, not lying almost along the horizon as was the case on the mornings of June 18 and 19 (see POPULAR ASTRONOMY, Aug.-Sept.). On August 27 at 3:50 A.M. the moon was well hidden by dense clouds covering half of the sky. The Light was in evidence as a faint, whitish band from the Milky Way in Gemini to the horizon in the western part of Leo. On September 12 from 3:30 to 4:10 A.M. in a perfectly clear sky the Light was seen from the Milky Way in Gemini to the horizon. Jupiter was almost on the south boundary which was clear-cut throughout. The horizon spread was about 25°. The intensity of the Light was fully equal to the Milky Way in the Gemini-Taurus area. The Light steadily increased in brightness. The first intimation of oncoming dawn was the obliteration of the sharp-edged south boundary which became diffuse. The major part of the Light was north of the ecliptic; the central line made an angle of 45° with the horizon. From the same latitude in the south hemisphere the slope of the Light would be northward instead of southward as with us. Also, in the south hemisphere the north and not the south boundary would be sharp-edged and the major part of the Light would be south and not north of the ecliptic. In the tropics, where the ecliptic makes a high angle with the horizon the year round, such differences are not known, for there the Light is seen as a fairly even column arching the sky.

EVENING ZODIACAL LIGHT.—On August 31 at 8:00 P.M. the Light was visible skirting the west and southwest horizon. Beginning below Cor Caroli it extended south to Arcturus and on almost to Alpha Librae. On September 3, from 8:00 to 8:15 P.M. it was seen along the horizon below Cor Caroli and Arcturus, thence almost to the head of Scorpio. The Light was very diffuse. At 9:30 an *aurora* band extended from the Dipper Bowl across to Capella. The lower boundary of the band was 5° above the horizon; the width of the band was about 7°; the luminosity was steady; no pulsings or columns were seen. At 10:15 it had faded out.

GEGENSCHEIN.—On September 11 at 11:30 P.M. the Gegenschein was observed in Pisces below the Pegasus Square. The boundary was very diffuse; the shape oval; estimated east and west diameter 12°.

The best time of year has come for observing Zodiacal Light phenomena. During October the Gegenschein will be passing along the ecliptic in front of Aries. It is always best seen at and for a month after the equinox, especially the autumnal equinox when, so to speak, it is on the upgrade of the ecliptic. For the next four months the morning Zodiacal Light will be well placed for observation. In a few weeks the evening Zodiacal Light will begin to appear conspicuously in our latitudes. It is hoped that observers will be able to spare some time to note these interesting spectacles of the night sky and any reports received will be welcomed for publication. It is requested that reports indicate date, time, length of observation, general appearance and size of the Light, altitude and azimuth and position with reference to the ecliptic, together with any fluctuations noticed, and the brightness as compared with any part of the Milky Way visible. Attention may also be given to the prevailing shade of color, more ruddy in the evening Light than in the morning, indicating perhaps the difference produced by a retreating and an approaching sun. Charts accompanying observation reports are always desirable.

The Rectory, New Market, Maryland.

GENERAL NOTES

Professor Edward S. King, of the Harvard College Observatory and one of the Councilors of the American Astronomical Society, died at his home in Cambridge on September 10 after an illness of about one month. He was seventy years of age.

Dr. E. A. Fath, director of the Goodsell Observatory of Carleton College, spent the summer months in research at the Lick Observatory. He was chiefly concerned with work by means of a photo-electric photometer attached to the 12-inch refractor. A paper by Dr. Fath, which was read at the meetings in Delaware, Ohio, in September, gives an account of some of the results of his work. Mr. Conrad Swanson, a student in Carleton, accompanied him and assisted in the investigations.

Mr. and Mrs. David B. Pickering returned to their home in New Jersey late in August from a seven months trip which took them as far as Japan. As on previous journeys, the astronomical observatories were the principal points of interest for Mr. Pickering. He has consented to share with the readers of POPULAR ASTRONOMY the experiences of his travels as far as that is possible through the medium of the printed page. In this issue will be found Part IX of his series of papers under the title "The Astronomical Fraternity of the World." Other parts, we are happy to say, will follow.

The Adler Planetarium during the second summer, as during the first, was again visited by large numbers of persons. On many days it was necessary to give one and sometimes two demonstrations, in addition to those regularly scheduled, in order to accommodate the waiting crowds. On September 2, fifteen months after the opening of the planetarium, the records showed a total of one million visitors. Dr. Dragstedt, professor of pharmacology at Northwestern Uni-

versity, happened to be the one-millionth. A representative of the Carl Zeiss Company, makers of the planetarium, was at hand and presented a pair of Carl Zeiss binoculars to Dr. Dragstedt.

The editor of this magazine had the opportunity of assisting in the lecture program during the month of August. It was an interesting and stimulating experience to see the enthusiasm, almost without exception, of those who witnessed the demonstration. Ideas which would ordinarily be incomprehensible to the average person are made intelligible and meaningful by means of the planetarium. Judging from expressions which were heard repeatedly, the work of this institution is greatly appreciated by the people of Chicago and is making a very significant contribution to the cultural and intellectual life of that city.

Professor Philip Fox, the director, is preparing two papers, one on the planetarium and one on the astronomical museum, which we shall present to our readers in the next few months.

Brilliant Rainbow Display.—While rainbows are not rare phenomena, the writer witnessed, last week, July 13, at 8:30 P.M., a display that he had never seen equalled, and considers it so unusual that mention might be made of it for the purpose of bringing out other observations along the same line.

A heavy rain storm passed over Pittsburgh the evening of July 13, coming from the west. The sun had not yet set, and after the rain stopped, and the storm had traveled some time towards the east, a beautiful rainbow made its appearance in the eastern sky. The width of the primary bow was approximately three degrees, measured with a movable protractor. Immediately inside this main bow, which touched the earth at the east and south points, and extended to an altitude of 45°, was a secondary rainbow, about half the width of the primary, just about half as bright as the main arch, which itself was extremely brilliant and pure. Inside of the complete secondary spectra were visible long arcs of the third, fourth, and fifth order spectra.

Concentric with the main arch, and about fifteen degrees higher, was another bow, comparable in magnitude with the secondary spectra mentioned. The duration of the entire display, which faded gradually but quickly, was fifteen minutes; for perhaps twelve of these it was of constant brilliancy.

LEO J. SCANLON.

1405 East Street, N. S. Pittsburgh, Pennsylvania, July 25, 1931.

A New Observatory in Stockholm.—The desire of Swedish astronomers for a thoroughly modern and well-equipped observatory has been met through the generosity of the Wallenberg family. Three years ago a donation of a million kronor was appropriated for the purpose from the Knut and Alice Wallenberg Foundation, and additional contributions have been given later. Though the new institution is placed at Saltsjobaden in the skerries, its main building crowning the wooded knoll of Mount Carlsbad, it will bear the name of the Stockholm Observatory. It was dedicated last May. (*The American Scandinavian Review*, for August, 1931.)

The Berliner Astronomischen Jahrbuch for 1933, according to a notice recently sent out by the Astronomisches Rechen-Institut, may now be procured for six marks, which is just one-half the usual price. This price applies also to the volumes for the preceding years, with the exception of 1932. Orders for these volumes may be sent to Ferd. Dümmlers Verlag, Berlin SW68.